American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

SEPTEMBER 9, 1948

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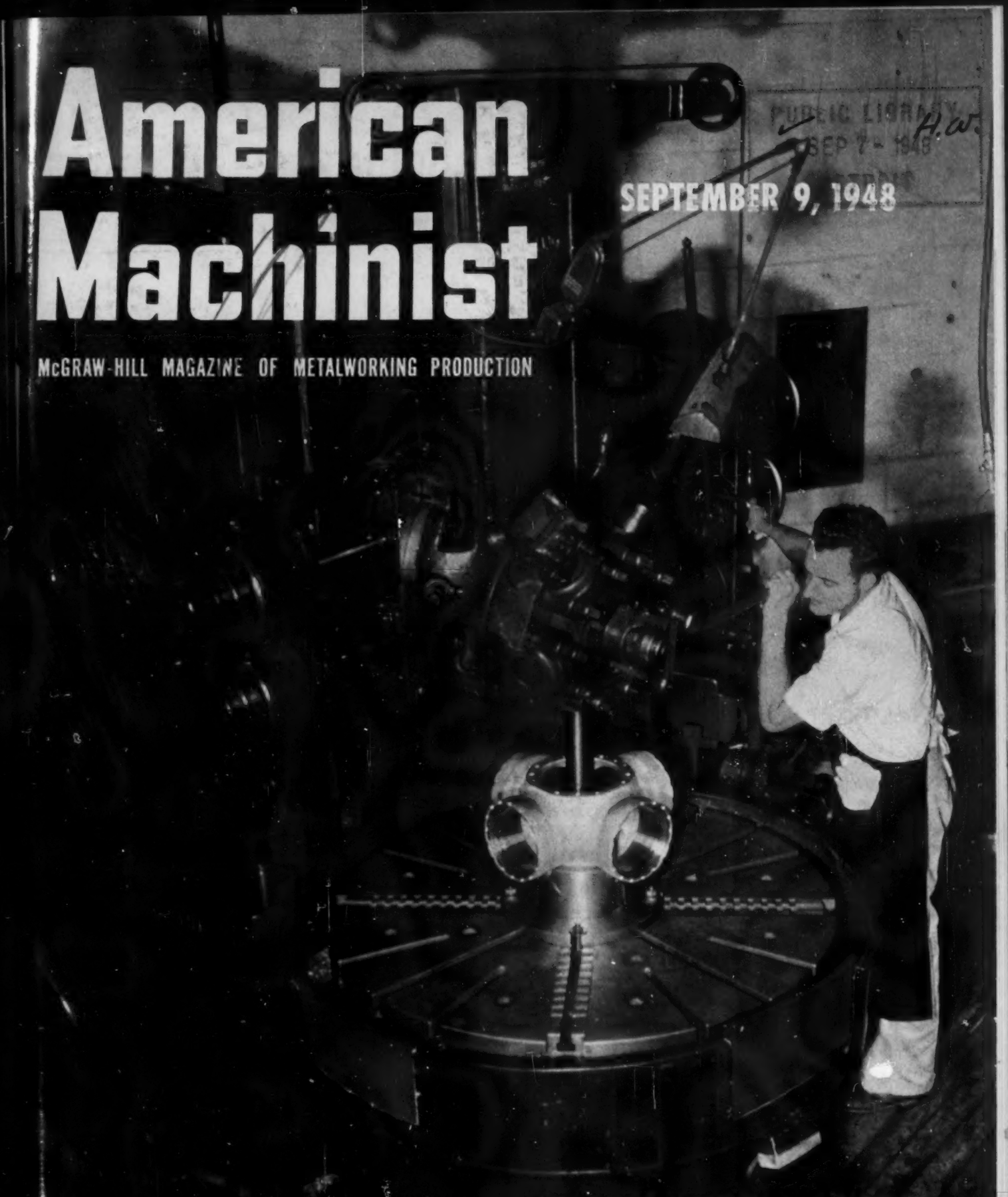

Refacing a B-29 prop hub at San Antonio
— see page 2

SELECTIVE SHOT BLASTING

SURFACE QUALITY — a special report

MECHANIZED CHIP HANDLING

√R v.925 Sept.-Oct. 1948

This New Addition to the Heald Line gives *NEW EFFICIENCY* in finishing small parts

It's the MODEL 171 Chuck-type Internal Grinder

IT'S THE 20th NEW HEALD MACHINE

With the *completely new* Heald 171, small to medium size parts can be precision ground on a mass-production basis—and with minimum effort! Grinding cycles are completely automatic once the work is loaded and the starting lever advanced. Outstanding design features include: *New Feed Mechanism—Uniform Speeds and Feeds—Sealed Hydraulic System—Centralized Controls—Anti-friction Cross-Slide—Rapid Machine Cycles—Automatic Lubrication—Isolated Power Unit.*

Like other Heald automatic internals, the 171 is available with both Size-Matic and Gage-Matic sizing, or with the Size-Matic method alone.

This latest addition to the Heald line is the result of over 20 years experience in building automatic internal grinders to meet the most exacting production requirements. Its many *new* design features assure greater precision—better finish—higher production—less operator fatigue—and easier maintenance.

For complete information, get in touch with your nearest Heald branch office—or, better still, come to Worcester and see for yourself.

HEALD

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

Tech

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Cover . . . Our reawakening airforce program is symbolized by the cover Kodachrome, taken at Kelly Air Force Base, San Antonio, Texas. Chas. W. Hardin, civilian employee, is refacing the cone seat and boring spline of a B-29 *Superfortress* propeller hub on a Bullard vertical turret lathe.

Air Force Day, marking the 41st birthday of the U. S. air arm and the first anniversary of the creation of the independent U. S. Air Force, will be observed Sept. 18. The Air Force was born in 1907 when the Army Signal Corps established a Division of Aeronautics "for the purpose of study of the flying machine and the possibility of adapting it to military purposes." Peak strength in 1945 was 2,411,000; current authorized strength is 360,000.

Blasting . . . It's time to review applications of shot blasting. We've done it in two lead articles. L. J. Wieschhaus of American Wheelabrator talks about blast cleaning in this issue; J. Epprecht and H. W. Eberhardt of Curtiss-Wright collaborate on shot peening in our next.

Debate . . . Bryan D. Miller, chief tool engineer of Century Electric, strongly questions the value of statistical quality control. So we asked Clifford W. Kennedy to take the other side. Their pointed debate is presented in this issue. . . . As other features, we show how veterans have taken jobs that prove they are neither "disabled" nor "handicapped," and have Robert C. Becherer, manager of the Ewart plant of Link Belt, explain his mechanized chip-handling system for the automatics there.

Smooth . . . Two years ago, our Chicago associate editor, Ben Brosheer, began the collection of available data on surface quality. His researchers led him to Detroit, Pittsburgh, and points east, and resulted in a compendium of information that would have required 56 magazine pages. We've compressed it into 32 which are presented in two 16-page special reports, in this and the next issue. We had, for example, a bibliography that included the literature of the world on the subject; we've compacted it into such sources as are readily available in the U. S. You'll want to burn a bit of midnight oil over this one.

Split Ticket . . . We recently mentioned in "Talking Shop" (*A.M.*, July 1, page 101) that there'd be fewer campaign buttons this year because cost had risen from ¾ to 2¼ cents each. We had in mind the traditional metal variety; we shouldn't have forgotten plastics. Now comes a letter, with prices and samples, from William H. Cranston, president, Standard Plastics Company, Inc., Attleboro, Mass. He sells buttons at $10 a thousand; stickpins at $40 per M, in white plastic—a molded elephant or a donkey head. The superstitious may augur something from the fact that the donkey button was broken on arrival.

Assembly . . . Furnace brazing has taken mighty strides in the last few years. H. M. Webber of the Industrial Heating Division of G. E. describes a number of typical assemblies from American Bosch which, by replacing complex machined units, cut costs. . . . Seth C. Klein, v.p. of production at Marmon-Harrington, describes aircraft-type fixtures in assembling trolley coaches.

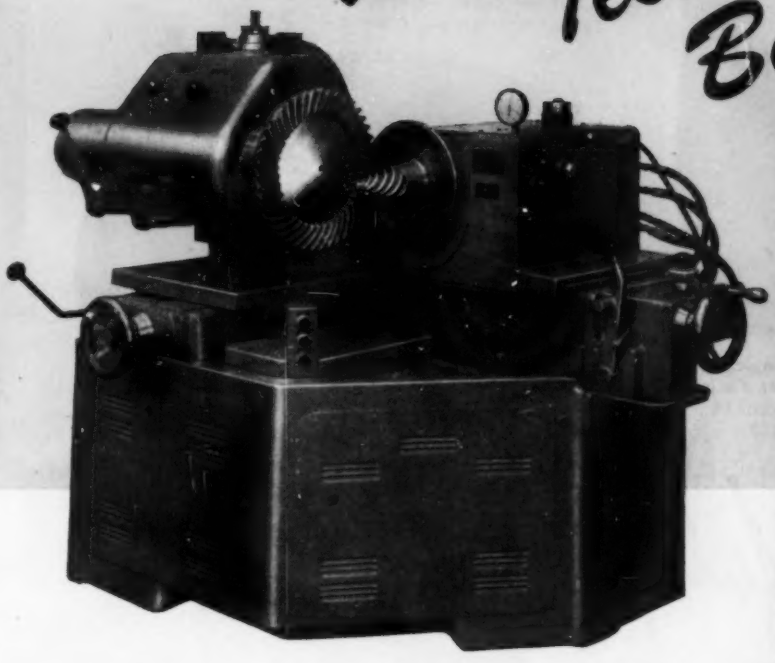
Gear Grinding . . . At the summer meeting of the AGMA, Dr. L. P. Tarasov of Norton Company presented a very extensive paper on gear-grinding troubles. It was so practical and down-to-earth that we made an exception to one of our own rules and present an abstract in two 4-page installments, here and next fortnight. . . . Also for tool engineers is Theodore Oshinsley's description of a progressive die that scores, trims and forms a 6-in. shell.

Coming . . . In addition to articles previously mentioned, *A. M.* for Sept. 23 will include articles on conveyor annealing, low-cost fixtures made from vises, welding fixtures, how to set a straightedge, and how to avoid metallizing failures.

BRAZING SPECIALIST . . . H. M. Webber received his B.S.E.E. from the University of Colorado in 1926. Since then he has been with the General Electric Company at Schenectady, N. Y.

Mr. Webber spent a year and a half on the student "test" course, and during the past 20 years has been an application engineer in G. E.'s Industrial Heating Division. Most of his work has been on controlled-atmosphere furnaces. He is regarded as being particularly well-versed in the problems of furnace brazing and an authority on the process. He has written many articles on this subject, the majority of which have appeared from time to time in the leading technical publications. His latest article appears in this issue.

Why Test Bevel Gears?



★ Testing simulates actual operating conditions, gears are rigidly mounted, run together in pairs under power and with a light load. Thus a check can be made for size, runout, smoothness and quietness of operation and tooth boring.

TEST GEARS

On the New Gleason No. 17-A Hypoid Tester

1. Before Production

In establishing the correct set-up for the gear generator, testing shows what readjustments of machine settings are needed.

2. During Production

Uniform quality of cut gears can be kept constant if checking is done during production.

3. Final Test

This determines the correct set-up for the bevel gears in final assembly. It eliminates the unnecessary tearing down and costly refitting.

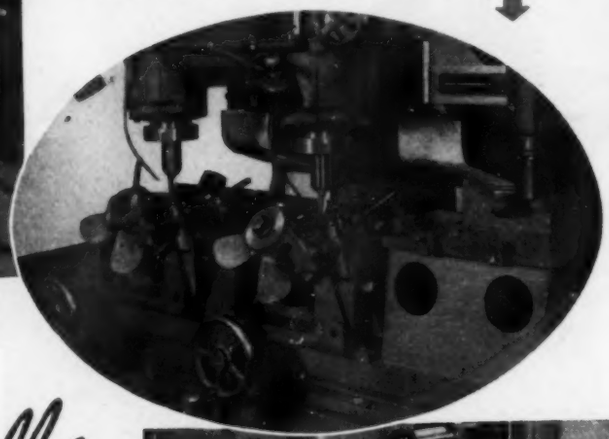
The No. 17-A Hypoid Tester is designed with a dial adjustment which once set up, automatically duplicates backlash on each pair of gears. Correct mounting is read simply and easily from an indicator and the best running position of the gears in final assembly is thus easily obtained.

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over Eighty Years

CINCINNATI Diesinking Machines may be employed in many ways. Here, a single throw crankshaft die is being faithfully copied from a master. CINCINNATI 16" Vertical Hydro-Tel Milling Machine. Catalog M-1497.

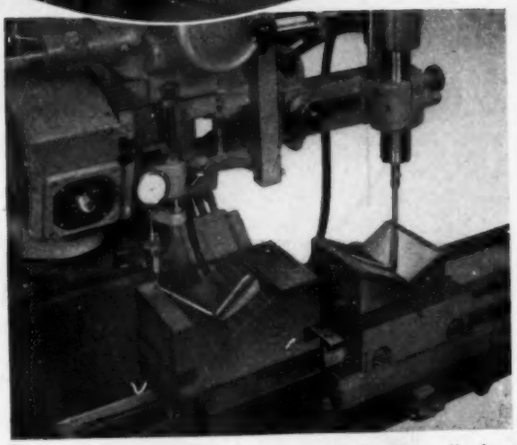
You can assign production milling work to CINCINNATI Diesinking Machines. In the illustration below, complex contours of propeller blades are followed faithfully by the tracer finger on this CINCINNATI 28" Vertical Hydro-Tel Milling Machine. Catalog M-1284-2.



Yours faithfully

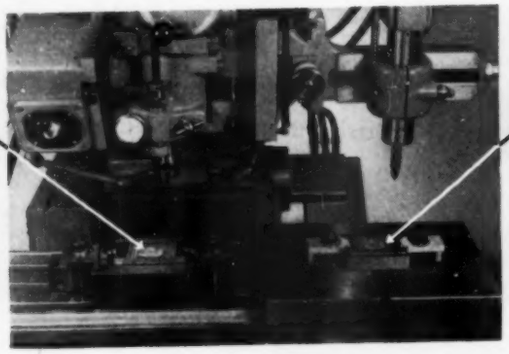
CINCINNATI DIESINKING MACHINES

Parts made from dies and molds can't economically be exactly like the original. But they will bear an accurate likeness to the original if the dies and molds are made on CINCINNATI Diesinking Machines. Costs will be lower, too, for these machines greatly reduce the time required for hand finishing. You can learn more about CINCINNATI Tool and Die Milling Machines by writing for the literature mentioned in captions.



Copycat in reverse. Excellent fidelity in a die for a left-hand golf club head is obtained from a right-hand master. Equipment consists of a CINCINNATI 8" x 18" Tool and Die Miller, equipped with a right- and left-hand attachment.

DIE



MASTER

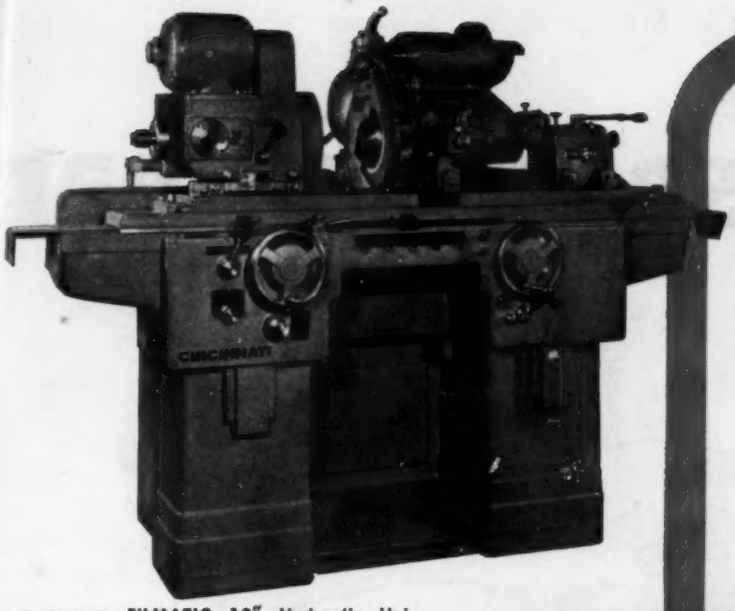
Left: Faithful reproduction is essential in milling an ornamental Indian head die. The die has not been hand-tooled nor the photograph retouched. The machine is a CINCINNATI 8" x 18" Tool and Die Milling Machine. Catalog M-1620.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID



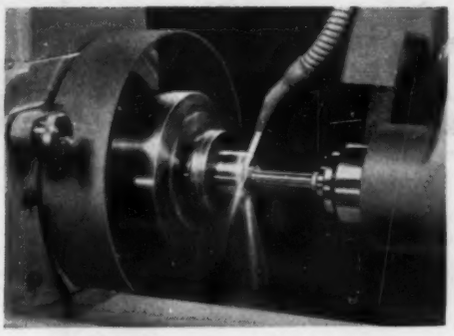
CINCINNATI **FILMATIC 10" Hydraulic Universal Grinder. Write for Catalog G-577.**

it changes "vs" to "and" in VERSATILITY and ~~vs~~ HIGH PRODUCTION

When you select your next precision universal grinder, there need be no conflict between versatility and high production. You can get *both* in the new CINCINNATI FILMATIC 10" Hydraulic Universal, for it has all the universal features you might expect, plus:

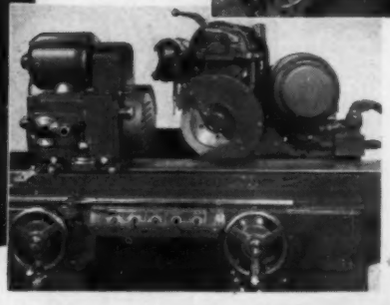
Hinged internal grinding unit for quick setups. Electronic headstock drive provides instant selection of the right speed, infinitely variable from 50 to 600 rpm. FILMATIC grinding wheel spindle bearings; they never require attention of a service man. *And:* wheel mount interchangeable from left- to right-hand end of spindle (additional equipment). *And:* manual or automatic infeed (additional equipment).

Many other features of these FILMATIC Universals contribute their share to low costs in the toolroom and on the production line. Complete description and engineering specifications may be obtained by writing for catalog G-577.



VERSATILITY
(Above) Internal Grinding Unit is set up by merely swinging it down.

VERSATILITY
(Right) Grinding the taper on an aligning bar.

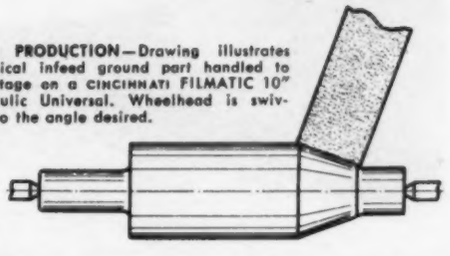


VERSATILITY
(Above) Face Grinding with wheel on the right-hand end of the spindle.

CINCINNATI

AUTOMATIC INFEED
makes the machine a high producer.

HIGH PRODUCTION—Drawing illustrates a typical infeed ground part handled to advantage on a CINCINNATI FILMATIC 10" Hydraulic Universal. Wheelhead is swiveled to the angle desired.

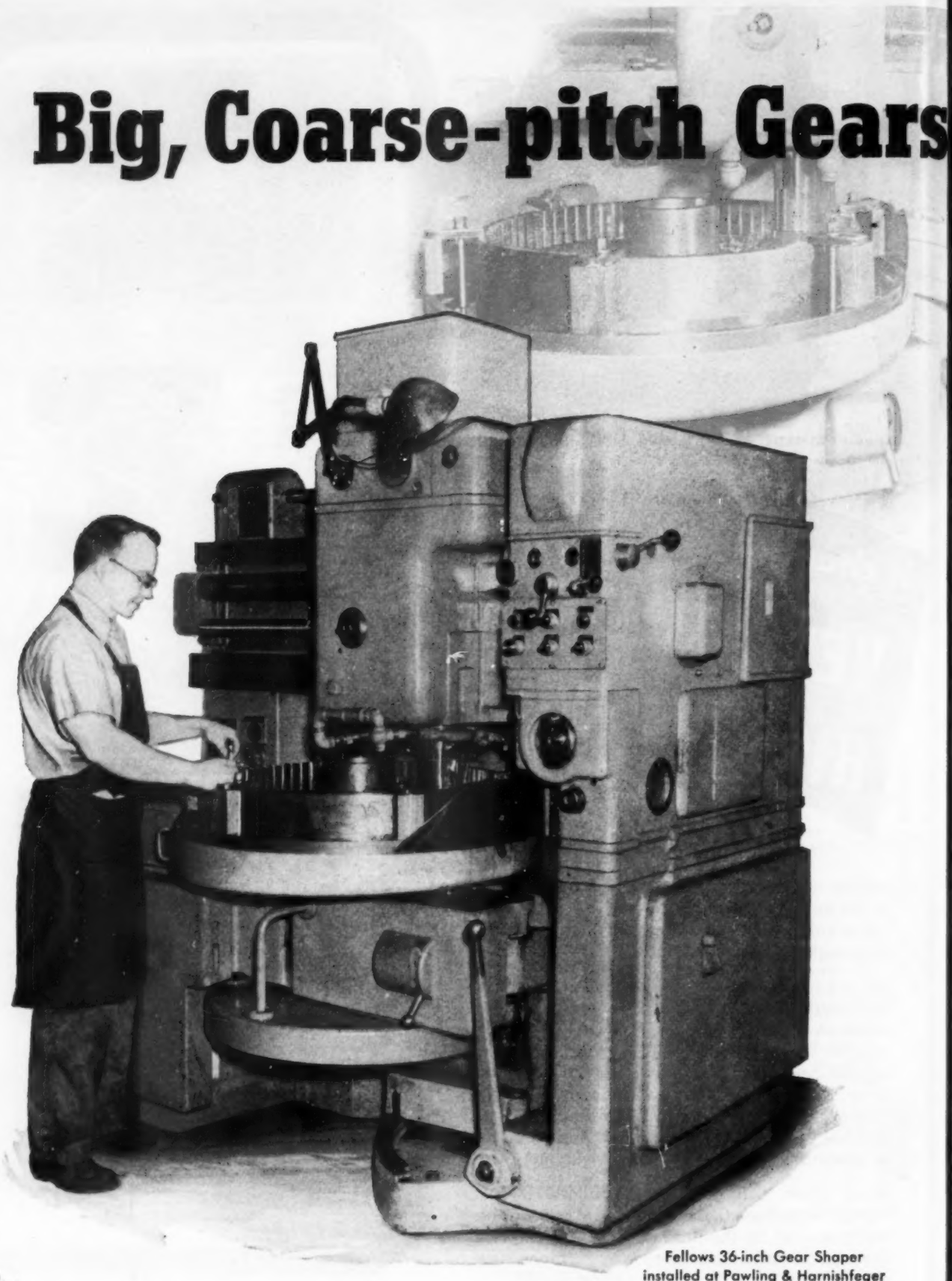


CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

Big, Coarse-pitch Gears.



Fellows 36-inch Gear Shaper
installed at Pawling & Harnishfeger

GEAR SHAPERS • THREAD GENERATORS • CUTTERS • SHAVING AND BURNISHING MACHINES

ROUGHED AND FINISH-CUT *in Record Time!*

31.2" P.D. INTERNAL GEAR
2½ diametral pitch
3.5" face width
78 teeth 20° stub 0.75" deep
Blank fabricated from SAE 1045 rolled stock heat treated to 214-241 Brinell
Roughed and finished in 3 hours
Harnishfeger Corporation, Milwaukee, Wisc.

New Fellows 36" Gear Shaper Cuts Previous 6 Hour Production Time to 3 HOURS Floor-to-Floor

A 50% time saving is mighty important in either production or jobbing-shop gear cutting. This new 36-inch Fellows machine is so ruggedly built that it is capable of taking extremely heavy cuts, and at the same time produces a smooth finish and a high degree of accuracy. It is provided with an arrangement whereby any number of roughing and finishing cuts can be taken automatically.

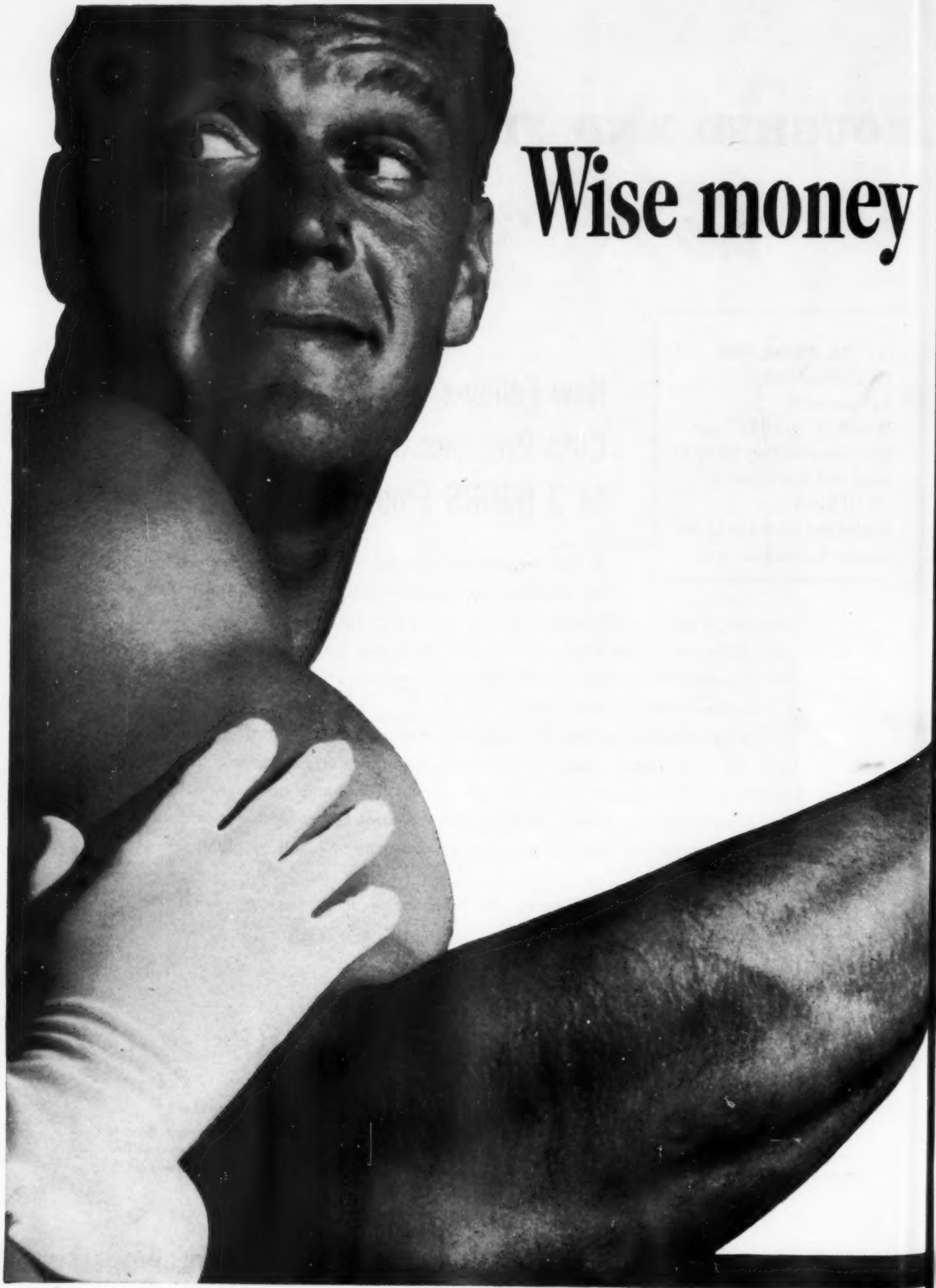
This is an all-purpose Gear Shaper adapted to the cutting of external and internal spur and helical gears and a large variety of work. Twelve quick-selective spindle speeds provides strokes up to 300 per minute. It is simple and easy to operate and is provided with centralized push-button control. Other features that facilitate quick set-up further adapt it to jobbing shop work, as well as high-production requirements.

Contact our nearest office for full information on this newest of heavy-duty Fellows Gear Shapers—the 36 inch.

Fellows

THE FELLOWS GEAR SHAPER COMPANY
Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Bldg., Detroit 2; 640 West Town Office Bldg., Chicago 12; 7706 Empire State Bldg., New York 1.

GEAR MEASURING AND INSPECTION INSTRUMENTS • PLASTICS MOLDING MACHINES



Wise money

rides on the champ

THE odds favor the champion. The champion got to the top by fighting his way there, by beating all challengers. That's why, in each new battle, the wise money is placed on the champ.

The champion has a record of successes; he has wise handlers who carry him through to *more* successes.

For this same reason, it does not pay to play hunches in your selection of alloy steels. Carilloy steels have a record of exceptional performance under all kinds of unusual conditions. And Carilloy's handlers – the Carilloy metallurgical engineers – are recognized authorities in the field of alloy steels.

When these engineers size up the job you have to do, they bring with them years of experience in the highly specialized field of alloy steel application. And they play no favorites because they have a complete list of fine alloy steels to pick from—bearing steels, aircraft steels, gear steels, Nitralloy steels, high temperature steels and low temperature steels, regular and special analysis steels of every kind. In any form and in any size.

So if your job requires the unusual in strength, toughness, durability, stamina, fabricating qualities—get their expert opinion. They'll help you pick the alloy steel that's right for the job and that you can put your money on with confidence.

U·S·S Metallurgical Engineers and the outstanding research organization behind them have played a leading part in the development of the triple-alloy NE steels, and in the inception and introduction of hardenability bands, isothermal transformation studies, and new and improved heat treating methods. Through constant research and experiment these experts are continually expanding the usefulness and efficiency of special steels for the special jobs of industry

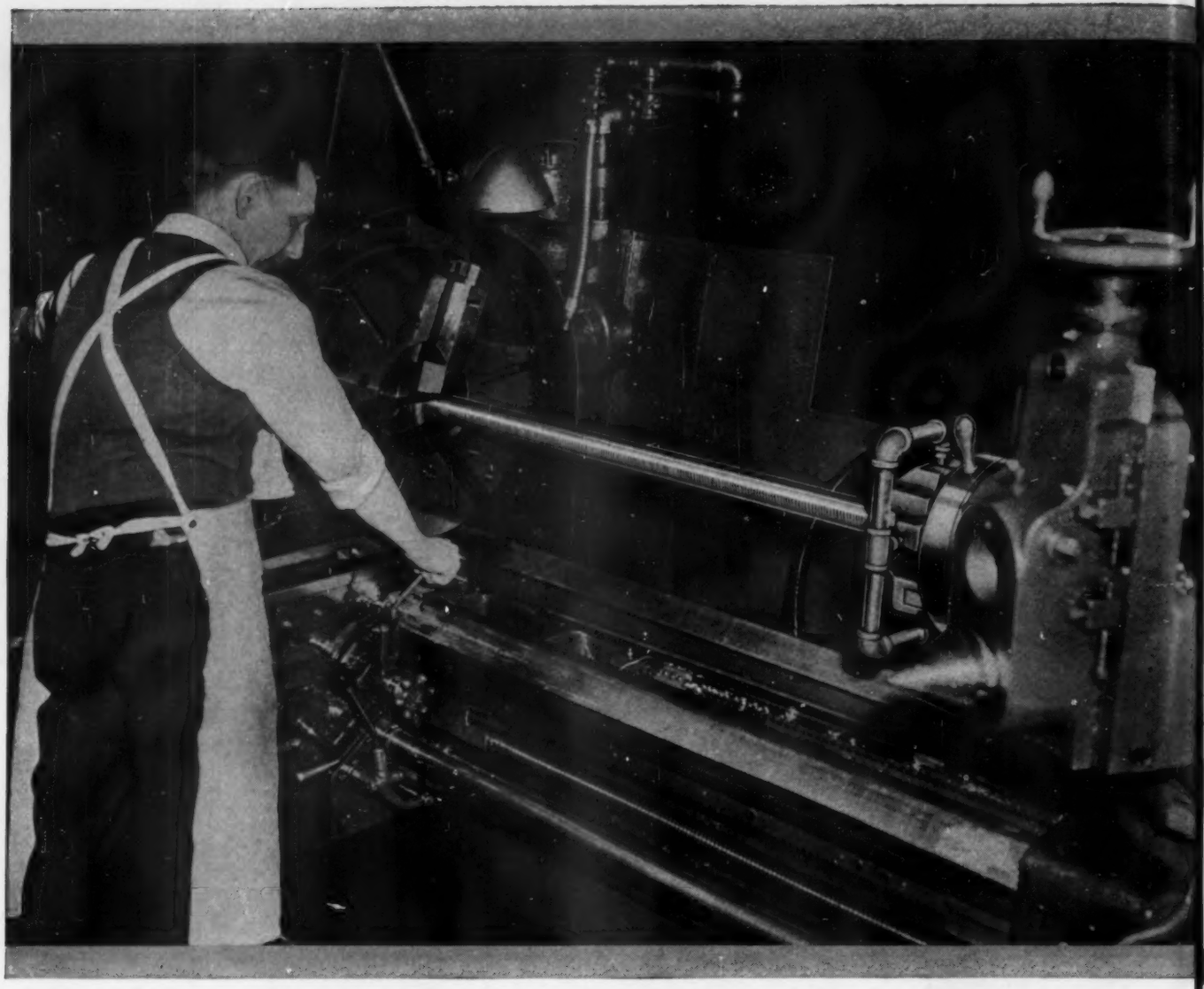
CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST TO COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Carilloy Steels

USS

ELECTRIC FURNACE OR OPEN HEARTH
COMPLETE PRODUCTION FACILITIES IN CHICAGO AND PITTSBURGH

UNITED STATES STEEL



"Only one cut is taken in forming the thread from the blank tube. This results in a tremendous saving in time over the former practice of chasing and grinding the threads, grinding being no longer necessary because of the accurate performance of the die head chasers," writes the manufacturer.

Illustrations show a 3" LANDMATIC Die Head used by a Western aircraft company to thread long Wing-Flap Retracting Screws to extremely close tolerances. An Acme thread of 2" diameter, 4 threads per inch, is being cut to a length of 45½" on heat treated alloy steel tube 48" in length.

Thread lead and pitch diameter are held within aircraft tolerances. Concentricity of thread with the O.D. of tubing and smooth finish is assured by the use of Landis tangential type centering throat and roughing and finishing form chasers. Centering throat section of the chasers takes a bearing on the O.D. of the tubing, eliminating an out of round condition that often exists when long work pieces are being threaded.

LANDIS MACHINE CO.

LANDMATIC Heads

For TURRET LATHE Threading Operations

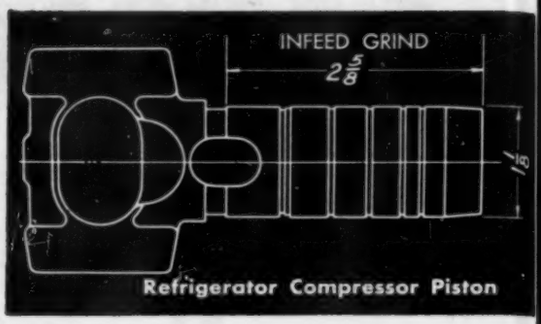
Write for Bulletins F-80 & F-90

WAYNESBORO, PA.

LANDIS
REG. U.S. PAT. OFF. TRADE — MARK

Special Tooling Produces 360 Pieces Per Hour

production	**360 pieces per hour**
finish	**10 micro inches**
tolerance	**.0003" on diameter**



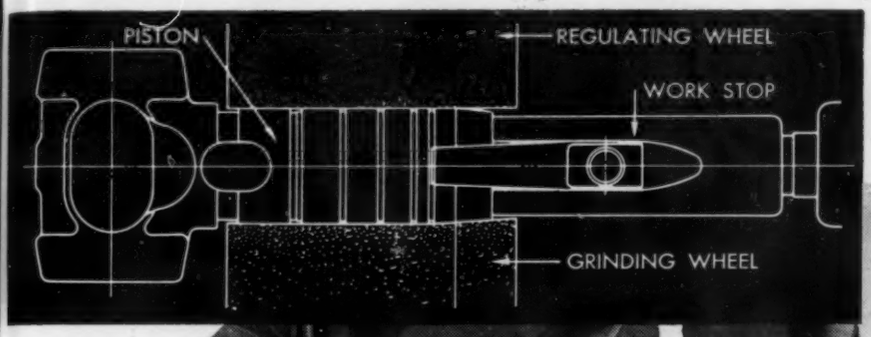
EQUIPPED WITH MICROSPHERE BEARINGS

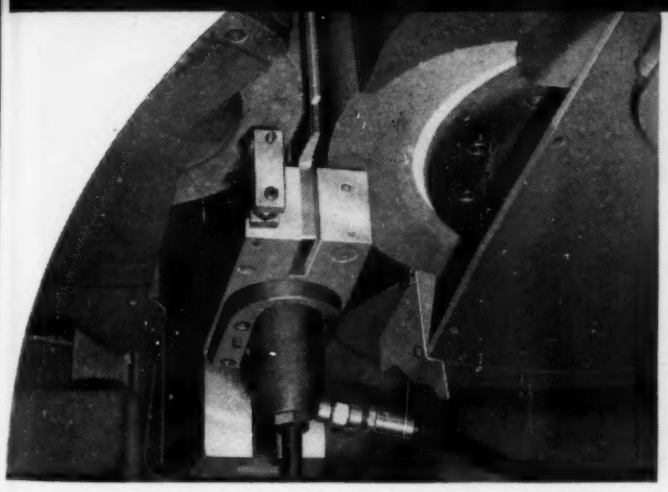
No. 12 Centerless Grinder
Catalog T47

LANDIS TOOL
Precision Grinders

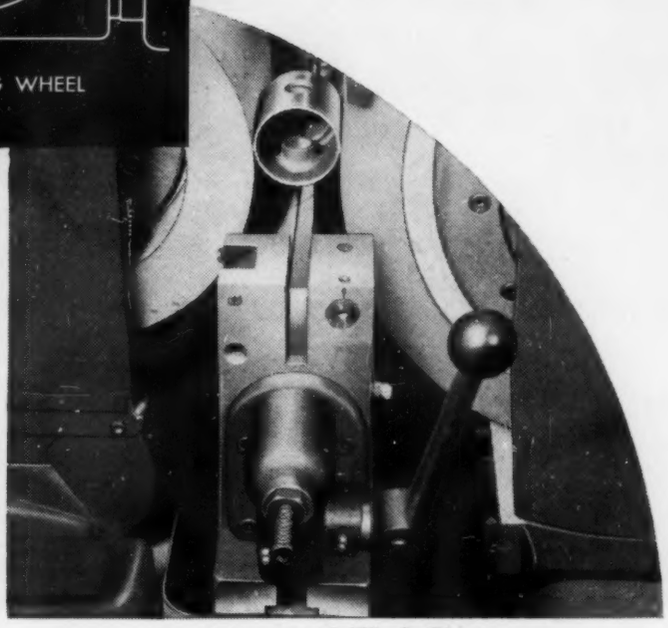
Production estimates and tooling recommendations will be made on the basis of your blueprints.

by Centerless Infeed Grinding

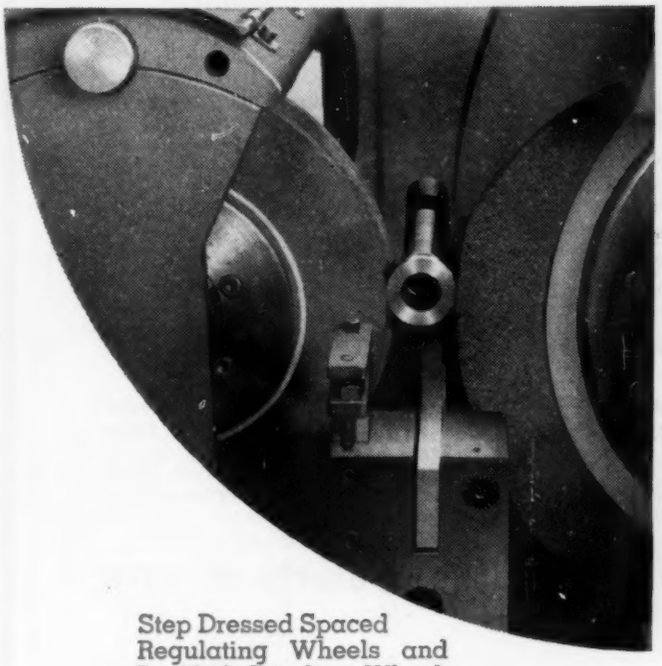




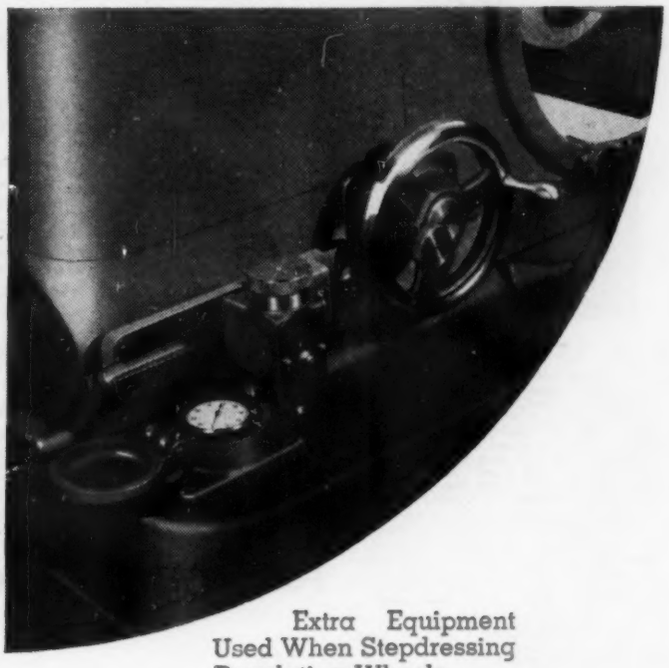
Air Operated Work Ejector



Hand Operated Work Ejector



Step Dressed Spaced Regulating Wheels and Profiled Grinding Wheel



Extra Equipment Used When Stepdressing Regulating Wheels

Other Tooling Available for Infeed Grinding Operations

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Van Keuren Wire Type Plug Gages

THESE EXTRA VALUES

FULL 1⅞" AND 2" LENGTH GAGING UNITS
ALWAYS ACCURATE — EXPERTLY ENGINEERED
LONG LIFE LIGHT ALUMINUM HANDLES
PROMPT DELIVERY FROM A STOCK OF 2 MILLION WIRES

TOOL ROOM SET NO. 80
Drill sizes from 1 to 80
(.228" to .0125").
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The New 1948 VK Catalog and Handbook No. 34 is a 208 page manual indispensable for engineers, designers, inspectors, toolmakers and machinists. It contains simplified formulas and accurate tables for measuring spur gears, helical gears, splines and worms. New and epoch making formulas and tables are presented for the first time for the exact measurement of 29, 40 and 60 single and multiple start screw threads and worms.

It includes a complete resume of American & European screw thread systems, new methods of measuring included angle of screw threads, a new method of inspecting flat ring seal surfaces with light waves, and other valuable information. Price $1.00 each postpaid.

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Wire type plug gages were originated by The Van Keuren Co. in 1925. They have resulted in gigantic economies for American industry and have been widely imitated.

Only in Van Keuren Wire Type Plug Gages is the maximum value of the gage dollar fully realized. The light aluminum handles are especially designed for utility, holding power and long life. The full length gaging units have a uniform high hardness, exceptional finish, long wearing qualities and superlative accuracy.

You do not need to inspect Van Keuren Plug Gages. Our double inspection at the factory takes care of that expense for you. There is no time lost in waiting for replacements.

Van Keuren prompt deliveries will enable you to cut your gage inventory to a minimum.

On your next order specify VK Wire Type Plug Gages. VK Carboloy for long runs because of the enormous saving in cost per hole gaged . . . VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that all the parts will be within specified limits. VK Tool Steel . . . VK High Speed Steel . . . Precision Chromium Plate for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

For Super Service . . . Phone Watertown 4394

THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

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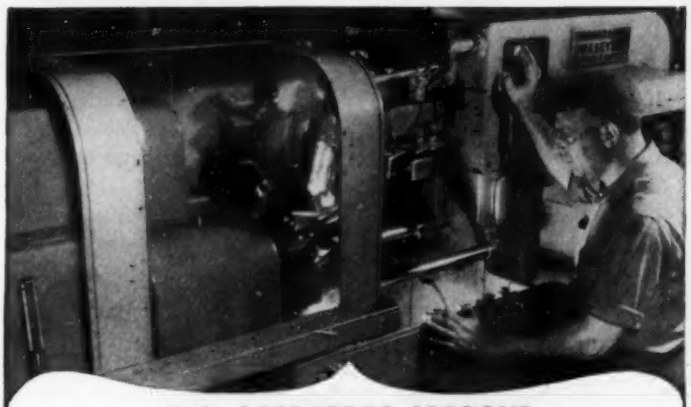
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

Warner & Swasey 5-Spindle Automatics cut Setup time *more than 50%*



YES, OPERATORS APPROVE

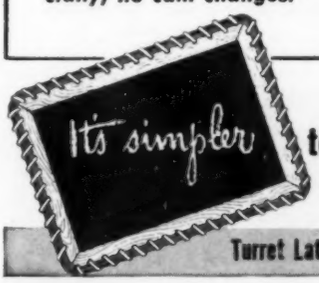
A true picture of a machine's all-around efficiency and ease of handling is often revealed by the attitude of the operators. Colson operator, Paul Gressler, with twelve years' experience, speaks for other fellow operators when he says he prefers Warner & Swaseys *"because of quicker setup, easy access and change-over of tooling—and especially, no cam changes!"*

● Simplicity of setup is a keynote of the new Warner & Swasey 5-Spindle Automatic. Colson Corporation, Elyria, Ohio, manufacturers of casters, material handling trucks, etc., find their new Warner & Swaseys have cut setup time by more than 50%—less than half that required on other modern multiple spindle automatics used in their plant.

The part shown above, a Fork Stem, SAE 1112 steel, is produced in lots from 500 to 10,000 pieces. It is typical of the jobs on which Warner & Swaseys are recording such big savings in setup time.

And Warner & Swasey efficiency does not stop with quicker setup. Production increases of 7 to 8 times over previous methods are being realized.

Repeat orders are probably the best proof of satisfactory performance. Colson's original order of two machines has now grown to a line of seven cost-cutting Warner & Swasey 5-Spindle Automatic Bar Machines.

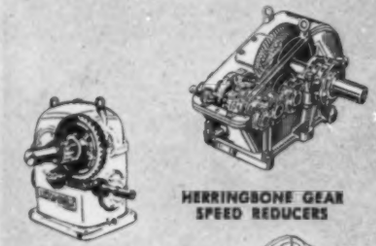


to set up a Warner & Swasey CAMLESS Automatic!

WARNER & SWASEY
Cleveland

Turret Lathes, Multiple & Single Spindle Automatics, Precision Tapping and Threading Machines

OTHER TYPES OF LINK-BELT POWER TRANSMISSION MACHINERY


HERRINGBONE GEAR SPEED REDUCERS

WORM GEAR SPEED REDUCERS

HELICAL GEAR SPEED REDUCERS

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P.I.V. GEAR SPEED VARIATORS

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ROLLER BEARING MOUNTED UNITS

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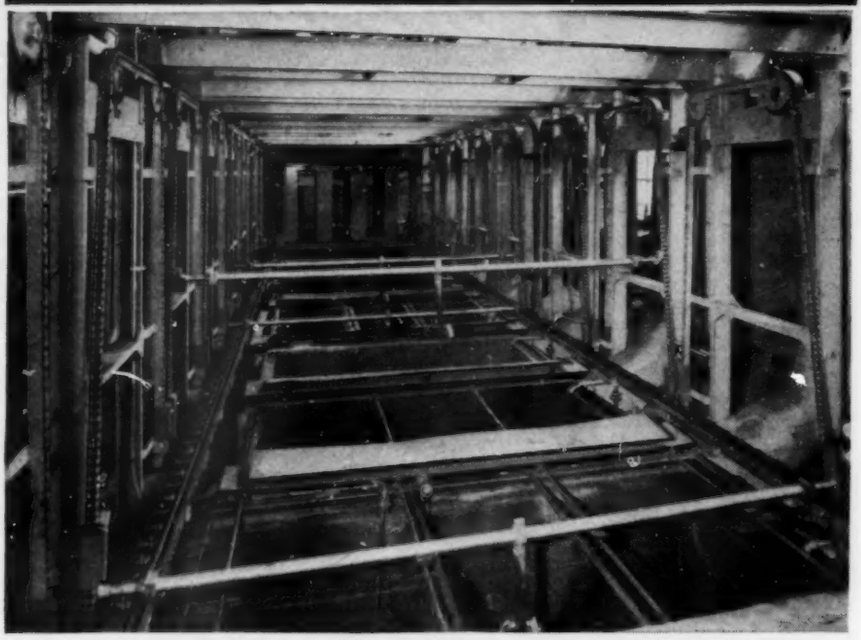
BABBITTED BEARINGS

THEY CHOSE LINK-BELT *Silverlink* ROLLER CHAIN *For Strength and Accuracy!*



CLEANING AND PLATING PROCESS DEPENDS ON ACCURATE TIMING OF SEVERAL OPERATIONS

From the view shown, it is apparent that chain forms a vitally important part of the Meaker plating machine illustrated. And because the satisfactory operation and long life of the equipment depends largely on the strength and accuracy of the chain, The Meaker Company selected Link-Belt Silverlink Roller Chain in various sizes, for their purposes.

Work in process is suspended from horizontal bars, riding on horizontal bus bars, and engaging parallel strands of Link-Belt "SS" roller chain, which propel the work across the tank. Transfer from tank to tank is done by loops of #120 Silverlink Roller Chain trained around four sprockets with special carrier cups for lifting the bar from one tank and lowering it into the next one. The lasting precision of Link-Belt chains maintains accurate timing — so essential to the functioning of this machine.

Link-Belt roller chains and sprockets are noted for their precision manufacture and long life. Link-Belt chain specialists can aid you in applying this flexible, positive, economical medium to your conveying and power transmission requirements.

LINK-BELT COMPANY

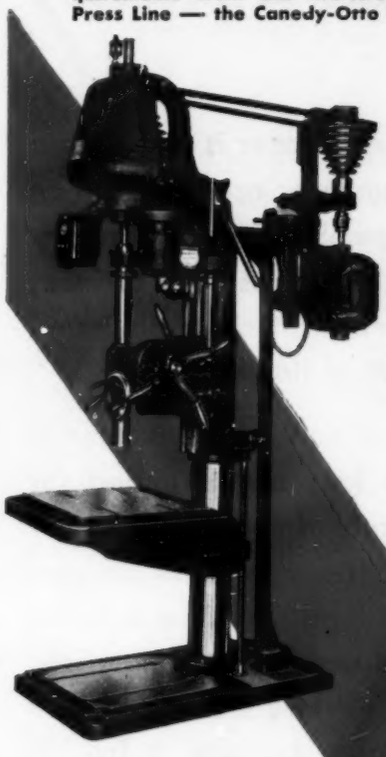
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
Offices, Factory Branch Stores and Distributors in Principal Cities. 11,145

LINK-BELT

Power Transmission Machinery

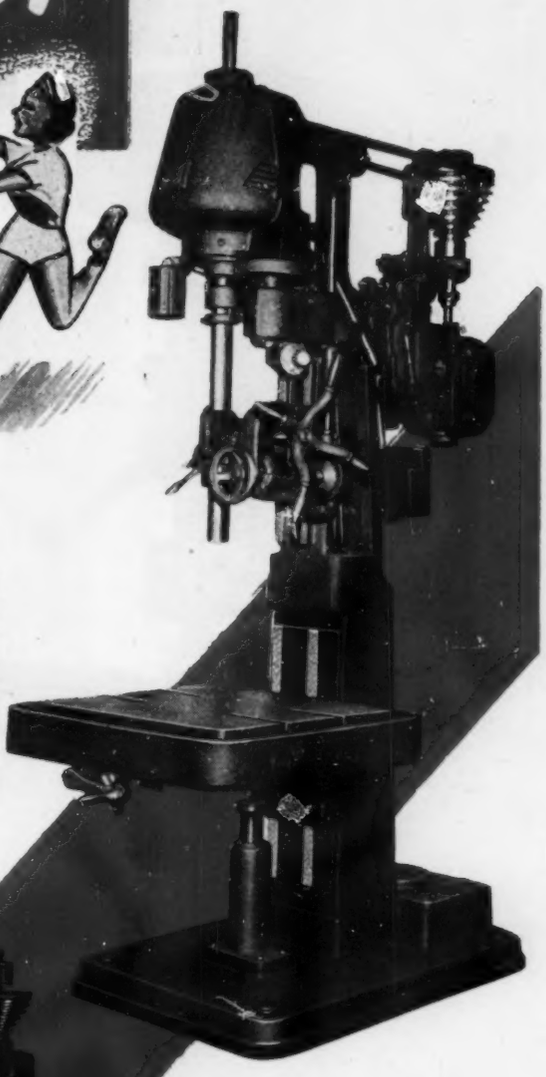
Built Right!

Like an athlete, a **CANEDY-OTTO** Drill press is stripped for fast, precision performance — no gadgets, no superfluous and costly attachments. Our 53 years experience as specialists in drill press design assure you that each unit is **BUILT RIGHT** — an advanced design, quality built for low-cost, accurate, high speed production. Fill all your drill press requirements from the World's Most Complete Drill Press Line — the Canedy-Otto line.



21" BOX COLUMN FLOOR DRILL

1½" capacity, available in one through six spindle models, of full ball and Timken roller bearing design. High alloy steel, heat treated spindle, with positive geared motor and automatic stop for predetermined depth drilling. Also operates through lever power feed or worm wheel feed. Eight step Vee belt drive on tilting motor bracket gives sixteen spindle speeds. Table, column and base of semi-steel casting, finished and normalized.



21" SLIDING HEAD FLOOR DRILL

1½" Capacity, 16-32 speed, single spindle model. Solid one-piece semi-steel cast frame with machined and integrally cast ways for movement of sliding head and table. Full floating spindle pulley. Spindle of heat-treated, high alloy steel, multi-splined. Available with Vee belt drive, back gear and power feed. Entire motor assembly mounted on famous C-O tilting bracket.

16" NO. 5-10,000 B.V. BENCH DRILL

A six speed, super-sensitive, high speed drill press available in 5/16"-3/8" capacity — floor or bench models — with one through six spindles. Ball bearing mounted, full floating spindle. Semi-steel cast column, frame, table and base. Motor unit mounted in famous C-O tilting bracket.

CANEDY-OTTO MFG. CO.

CHICAGO HEIGHTS, ILL.

Canedy-Otto Mfg. Company
Chicago Heights, Illinois

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2 NEW

NORTON SEAL-O-LAP
Single Surface Lapping Machine

The NORTON SEAL-O-LAP Lapper is designed to produce superior seal surfaces economically on the component parts of rotary seals. It finishes these surfaces to low micro-inch readings and to optical flatness.

Bonded abrasive laps are furnished for surfacing seals made of carbon, bronze or other materials difficult to finish on conventional metallic laps. Cast iron laps are furnished if parts are of hard materials. This machine gives rotary seal surfaces an ideal type of finish, because it finishes each work part with a positive rotary action.

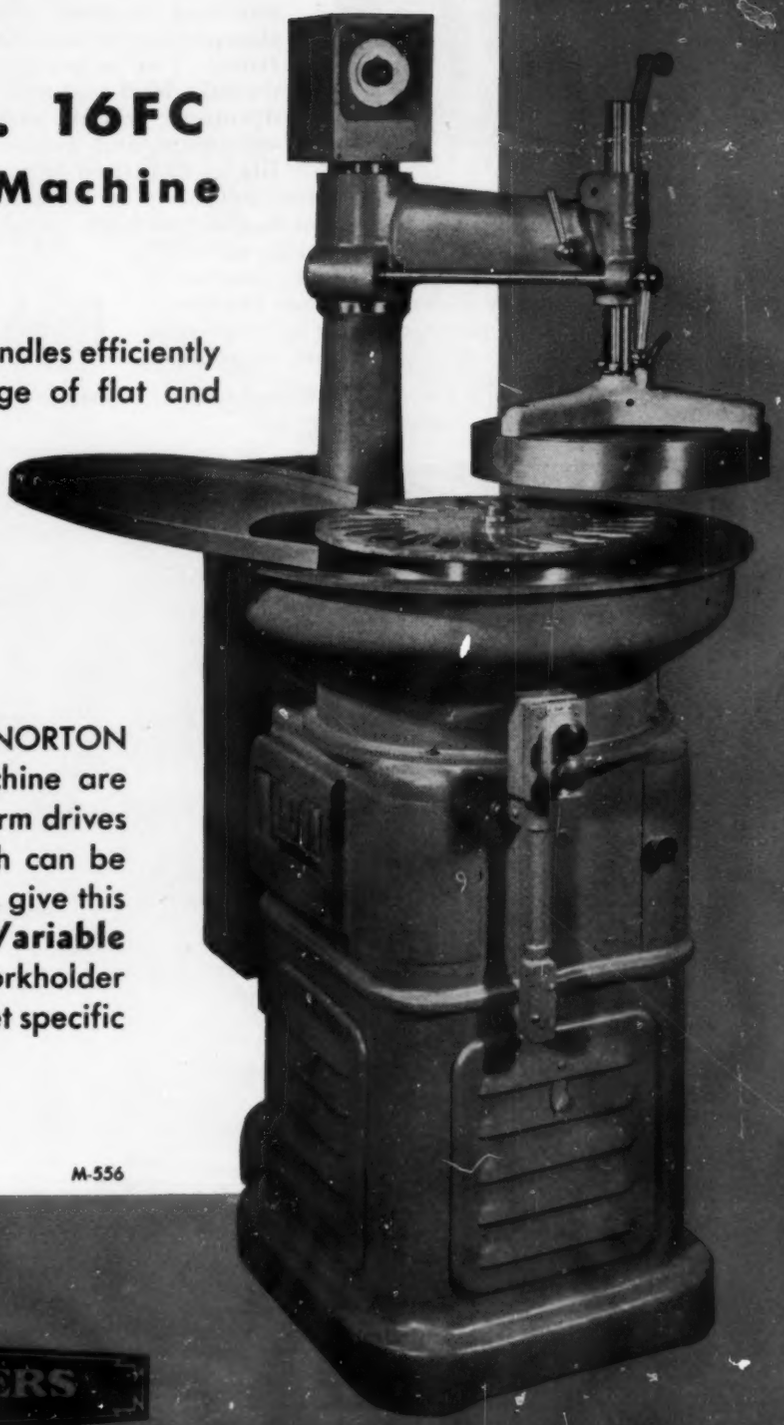
Catalog #215-I
gives further details

NORTON GRINDERS and Lappers

Abrasives • Grinding Wheels • Grinding and Lapping Machines • Refractories • Porous Mediums • Non-slip Floors • Norbide Products

Lappers

NORTON No. 16FC
Vertical Lapping Machine



This universal lapping machine handles efficiently and economically the wide range of flat and cylindrical work within its capacity. It is a sturdy, dependable producer, the latest in a line of lapping machines which make the attainment of fine accuracy a commonplace accomplishment.

Two outstanding features of the NORTON No. 16FC Vertical Lapping Machine are as follows: **Dual Drive**—two worm drives which are independent but which can be operated in several combinations, give this lapper unusual flexibility. **Variable Speeds**—speed of both the workholder and the laps may be varied to meet specific requirements.

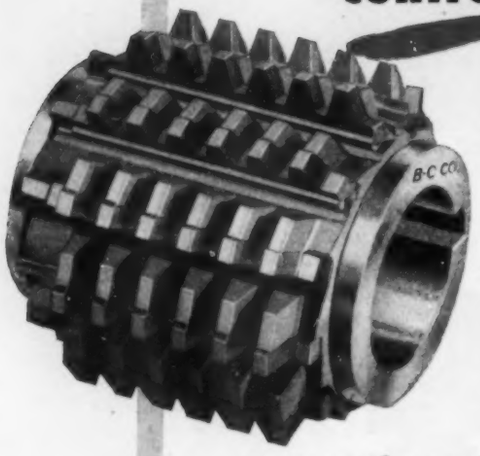
Catalog #212-I
gives further details

M-556

NORTON GRINDERS
and Lappers

NORTON COMPANY, WORCESTER 6, MASS., Distributors in All Principal Cities

controlled sharpening is economy!

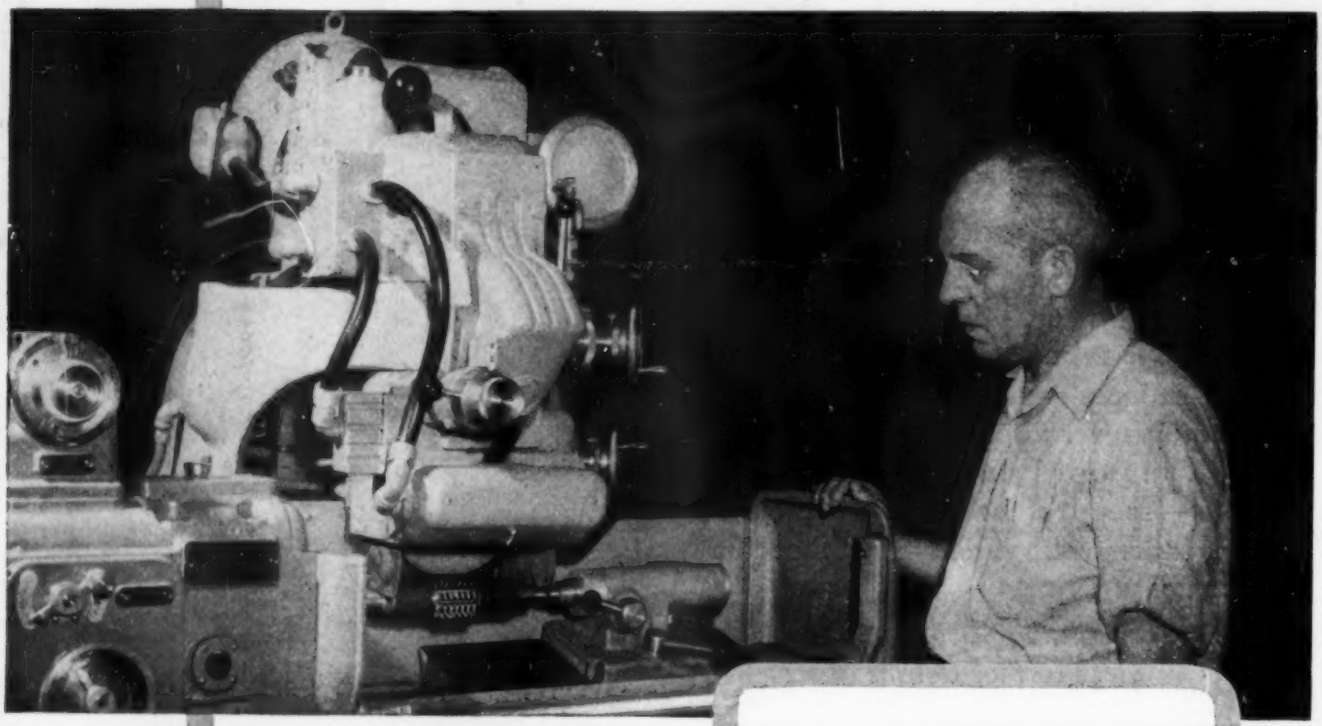


Three hours were formerly required to sharpen this carbide-tipped hob on conventional sharpening equipment. The No. 6-5 Hob Sharpener does the job in 42 minutes, holding indexing within .0005", and radial face alignment within .0007". As a result of complete mechanical control provided by the machine, precision sharpening is obtained in less than one-third the usual time. Two other important savings are realized in reduced wheel cost and longer tool life. The large diameter diamond wheel, plus wet grinding, increases cutting efficiency and reduces wheel breakdown. Longer tool life is obtained because less material must be removed to secure the required accuracy on indexing and cutting faces . . . The No. 6-5 machine is designed to sharpen high speed steel or carbide tipped hobs, formed cutters or thread mills up to 6" diameter and 5" face. Accuracy and efficiency of your sharpening operations can be improved with this precision machine.

Write for complete information. Ask for bulletin No. 3213.

Barber-Colman Company

GENERAL OFFICES AND PLANT 116 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.



BARBER COLMAN

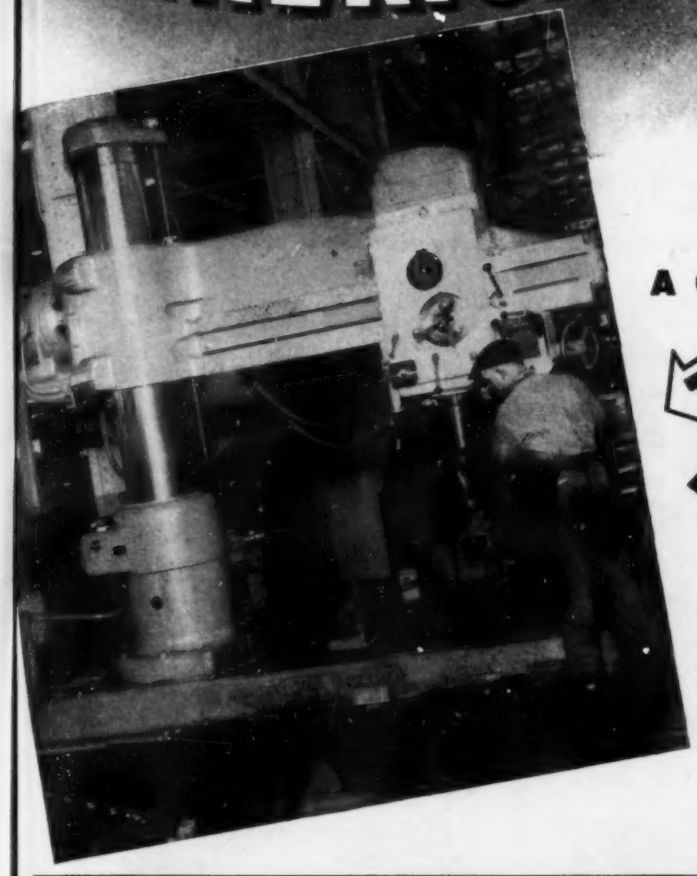
EASIER, MORE ACCURATE HOB SHARPENING

JOB FACTS

Operation—Face sharpen carbide-tipped hobs, 2-3/4" x 2-3/4", 12 gashes.
Cutting Faces — Radial
Feed per Rev. — .0004"
Wheel — 7" diamond, 3600 RPM
Stock Removed — .020"
Coolant — Oil
Sharpening Time — 42 min. (Former Time — 3 Hours)
Accuracy — Adjacent Spacing .0005", Radial Faces — .0007"

"AMERICAN" Versatility

An Asset in the Railroad Shop!



A QUICK CHANGE FROM

THIS

...to THIS

This "American" Hole Wizard Radial in the C. & O. R. R. Shops at Huntington, W. Va., seems to be a "jack of all trades."

As shown by the accompanying illustrations, one minute it's reaming cross head fits, the next it's on an emergency job drilling ¾" holes.

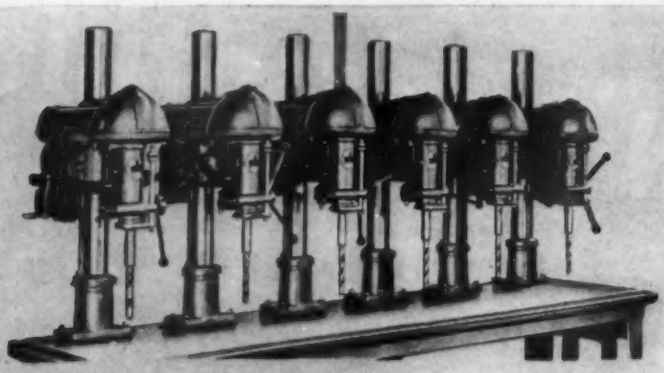
The Hole Wizard's wide range of speeds, its concentration of all controls at the head, its patented Double Lo-Hung Spindle Drive, great power and rigidity make it an outstanding machine for both production jobs and miscellaneous work of various kinds.

THE "AMERICAN" HOLE WIZARD IS A BULWARK OF PRODUCTION IN THE SHOP.

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

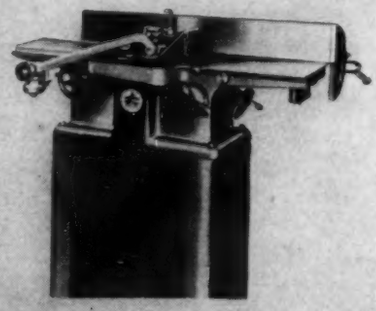


Multi-Spindle 20" Drill Presses—Capacity: steel, ¾"; cast iron, 1". One to six spindles of 6" travel. Spindle nose to table 25". Hand or power feed. Five spindle speeds.

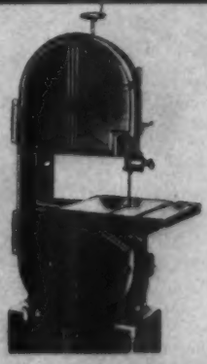
20" Floor Model Drill Presses—Capacity: steel, ¾"; cast iron, 1". 6" spindle travel, hand or power feed. Five speeds.

15" Drill Presses—½" capacity Jacobs Chuck, 4¼" spindle travel; four speeds, 600 to 5000 R.P.M. with 1740 R.P.M. motor.

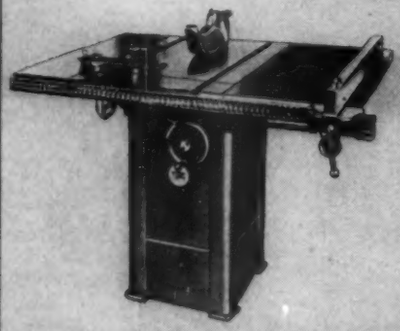
Grinders—Ball bearing models in 10", 7" and 6" wheels. Ample clearance, guarding and dust protection.



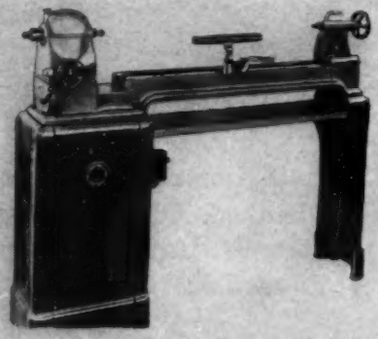
6" Jointer—Planes accurately; rabbets ½" deep. Cuts ribbon thin, handles narrow strips safely. Quick set-up and locking.



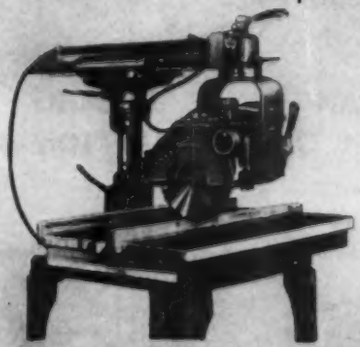
14" and 16" Band Saws—61 to 5300 S.F.P.M. according to model. Table tilts 45°. Dynamically balanced wheels.



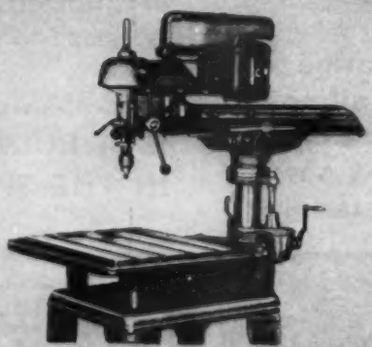
10" Tilting Arbor Saw—Depth of cut, 3⅛". Blade-arbor tilts to 45°. Self-indexing miter gauge. 1 H.P., 1 phase; 1½ H.P., 3 phase.



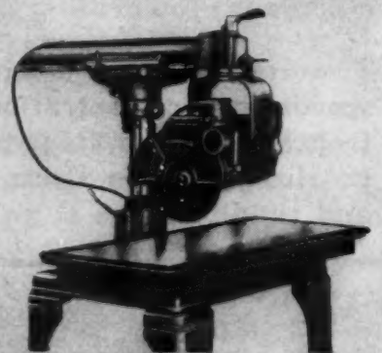
Lathes—wood or plastic; soft metal spinning; gap swing 15", 12" over bed; 38" between centers. Speed ranges 290-3750 R.P.M.



Radial Saws—for wood, plastic; cut 4¼" deep with 12" blade. 21½" ram travel, rips 38" wide, cuts any angle. 1, 1½, 2 or 3 H.P.



Radial Drill—reaches 62" for wide bulky work. Head tilts 45°, 4¼" spindle travel, ½" Jacobs Chuck. Sixteen spindle speeds.



Radial Metal Cut-Off Machines—4¼" clearance depth with 12" wheel, cutting arc up to 1"; 21½" ram travel. 1, 1½, 2 or 3 H.P.

Die and pattern shops

Machine shops

Maintenance departments

Box and crate departments

SPECIFIED BY INDUSTRY

WALKER-TURNER LIGHT MACHINE TOOLS

Service and repair shops

In almost every manufacturing plant — in practically every industry where metal, wood or plastic is drilled, cut or shaped, Walker-Turner Light Machine Tools are on the job. Adaptable to the most unusual or difficult problems in die, pattern and machine shops, in box and crate, service, repair, maintenance and other areas, Walker-Turner will meet the most exacting requirements—give years of service. Specify Walker-Turner Light Machine Tools right down the line in your plant. *For complete catalog, write to Kearney & Trecker Corporation, Walker-Turner Division, Plainfield, New Jersey.*

walker-turner LIGHT MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED
RADIAL DRILLS • RADIAL SAWS
BAND SAWS—FOR WOOD OR METAL
RADIAL METAL CUT-OFF MACHINES • MOTORS

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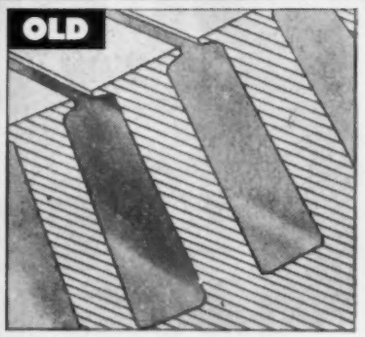
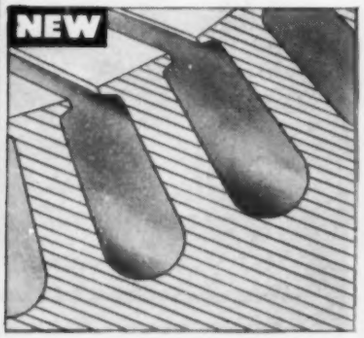
Life-Line ..



Usual slot design is rectangular, with sharp corners into which slot cell insulation must be creased and coils must be pushed.



Life-Line slot design is pear-shaped. Coil slips in easily and fills slot—no corner voids remain to collect dirt and moisture.

NEW METHODS . . . NEW MATERIALS . . . OPEN WAY TO LONGER ELECTRIC MOTOR LIFE

An electric motor's "muscle" consists of the "sinews", or coils of wire, packed into slots in the stator of the motor.

If these are "bruised", or cramped or damaged while being put in—or if spaces are left for dirt or moisture to gather—protective insulation breaks down and electrical failures result. *Most motor failures are caused in this way.*

Life-Line—industry's all-steel motor—overcomes these common causes of motor failure. New, pear-shaped slots enable coils to be slipped into place without stress, eliminating need for tapping. No slot corners are left to require creasing of the slot insulation, nor to gather dirt in these voids.

New electrical design is just one of the benefits Life-Line motors bring to builders and users of motor-driven equipment. Get the details on Life-Line's smaller size, lighter weight, greater strength and smoothness.

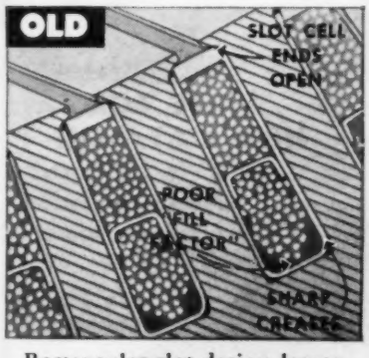
Life-Line motors, now built in sizes from 1-15 hp, are available from stock in standard and near-standard types. "Specials" in Life-Line design are available on short shipment. Other sizes and types—up to 200 hp—soon will be changed over to modern Life-Line design. Check your nearest Westinghouse office for deliveries—or write or wire today to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-21456

Westinghouse

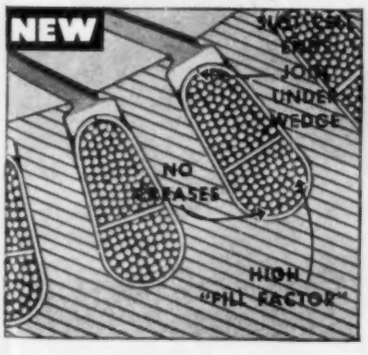
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Life-Line motors



Rectangular slot design leaves many unfilled pockets for dirt, dust and moisture to accumulate and cause deterioration.

Old slot shape frequently required tapping last wires of the coil into position with resulting possible damage or weakening of insulation.



Pockets are eliminated—cell insulation is lapped over and covered by wedge. No sharp creasing of insulation is necessary.

Life-Line "pear-shaped" slots permit coils to be inserted snugly into position without need for tapping or weakening of the insulation.

LONGER LIFE ON THE JOB with freedom from electrical failures is assured by Life-Line motor manufacturing methods and new insulating materials.

Large Carbide Tipped Reamer for machining cast iron cylinder drum of railway car hydraulic system. 19 in. dia.

Gang Milling Cutter with special Radius Mill for machining centrifugal casting mold for soil pipe. 15½ in. long, 12 in. dia. large cutter.

Special Boring and Facing Head. 14 in. long, 5 in. max. dia.

Special tool for reaming Diesel engine cylinders. 28½ in. long, 5½ in. dia.

multiple

WRITE FOR NEW CATALOG

Three-step Boring Head for machining mild steel gear box for a harvesting combine. 38 in. long, 5⅜ in. max. dia.

le operation tooling

O K SPECIAL TOOLS for executing several operations with one pass of the tool range from simple two-step reamers to complicated gang set-ups and combinations for boring, facing and chamfering at the same time. Each tool is individually engineered to the job. This system of removing more metal per-man-per-machine evolves from an experience of 47 years. It offers sizable savings to every manufacturer facing pressing needs to hold costs down now or regret the day.

O K multiple operation tools are built with the famous O K wedge-shape, inserted blades of high speed steels, cobalt, cast alloy or carbide tipped. They are held in position absolutely by the simplest device—a driving fit; extracted in a second with a drift. No pins, screws, gibs or extraneous locking blocks are needed. In the opinion of the best minds in the metal cutting shops this is the ideal construction because it provides the great staying power and the ability to withstand shocks and strains of today's high speeds and feeds, especially for milling with carbide.

A copy of the new O K Tool catalog, "Modern Milling Cutters for Modern Milling Machines" mailed on request.

The OK Tool Company, inc.
HULL STREET, SHELTON, CONN.

O K SPECIAL TOOLS FOR

AIRPLANES
Milling cam shafts
Milling strut flanges
Milling wheel supports

AGRICULTURAL IMPLEMENTS
Boring transmissions
Facing motor blocks
Boring and reaming differentials

AUTOMOBILES
Milling crankshafts
Boring cylinder blocks
Reaming motor blocks

ELECTRICAL APPLIANCES
Boring and facing motor end bells
Milling motor bases

MACHINE TOOLS
Face milling machine tables
End milling angular ways
Boring machine bases

PLUMBING SUPPLIES
Facing valve flanges
Reaming valve bodies

RAILROAD LOCOMOTIVES
Face milling connecting rods
End milling driving boxes
Boring driving boxes

SHIPS
Drive shaft milling
Boring valve holes in large Diesel engines
Face milling engine heads

TEXTILE MACHINERY
Gang milling small loom parts
End milling bosses

TRUCKS & TRACTORS
Gang milling cam shafts
Boring rear end housings
Face milling engine blocks

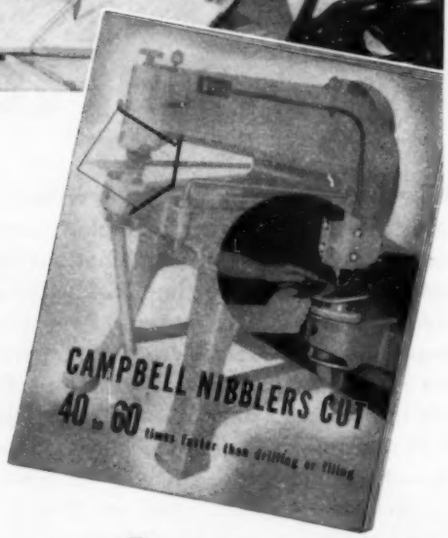
maybe we could *nibble it!*

. . . and very often that's the *best solution*

If it's a problem of cutting irregular shapes out of sheet metal — in quantities that don't justify making a special die — a CAMPBELL NIBBLING MACHINE very likely will give you the solution

Campbell Nibblers are making themselves indispensable in tool rooms, machine shops, experimental departments, sheet metal departments, even production lines. From a wide range of models you can select the one that will serve you best.

Let us send you a copy of our newest booklet about Nibblers. Just write for DH-593.



THIS BOOKLET gives you detailed information about Campbell Nibbling Machines —their possibilities and limitations.
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CUT • TAP
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Why You'll Get Better Production...Lower Turning Costs with a MULTIPLE TOOLED AUTOMATIC CYCLING SUNDSTRAND LATHE

● Whether your turning problem is a long run production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle changeover. They will also assist in designing the most profitable processing method for the job at hand.

All of the advantages of multiple tool turning are available for both short run and long run production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes.

Described here are several typical cases in which Sundstrand "Engineered Production" assisted plant engineers in designing a tooling method which resulted in lower turning costs.

Short Run Turning of 100 Different Parts in Lots of from 25 to 100 Pieces This manufacturer handles over a hundred different parts in lots from 25 to 100 pieces on Sundstrand Automatic Lathes. Tooling set-ups for the various jobs are made quickly and easily by use of the universal or "open-air" type of tool block which permits adjusting the tools in numerous positions. Tooling inventory is low . . . tool set-up time is fast. Average changeover time from one lot to another is less than 45 minutes.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

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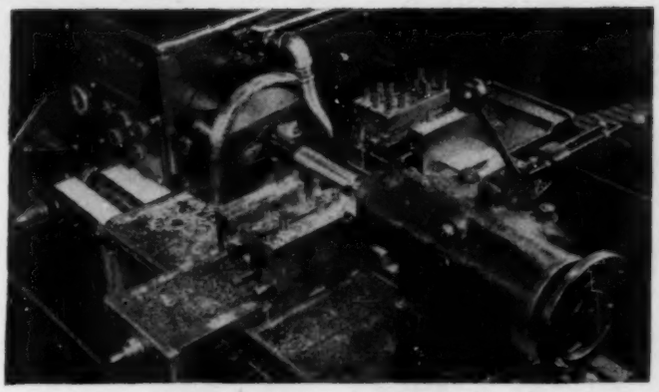
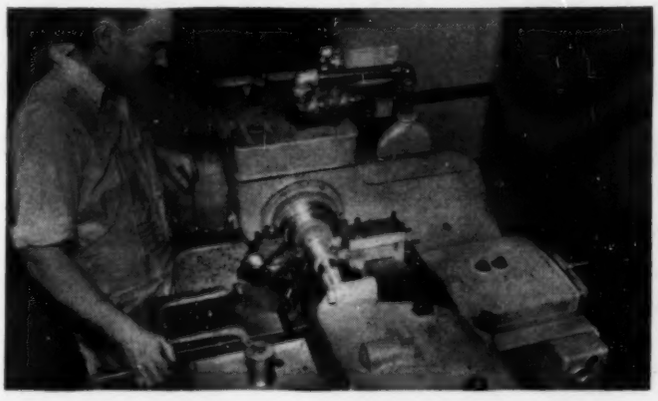


Turning 100 Clutch Shafts Per Hour With Standard Tool Blocks This Model 4 Sundstrand Automatic Lathe is equipped with standard tool blocks mounted on dove-tail base. Tool blocks are easily adjusted. With a minimum of extra tooling, over 100 different parts in lots ranging from 20 to 1000 pieces are run on this standard machine. On the shaft shown, two diameters are turned, the radius is formed and chamfered at the rate of 100 pieces per hour.

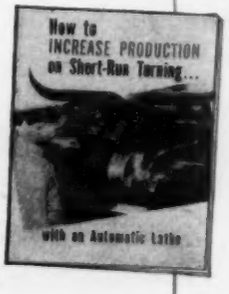


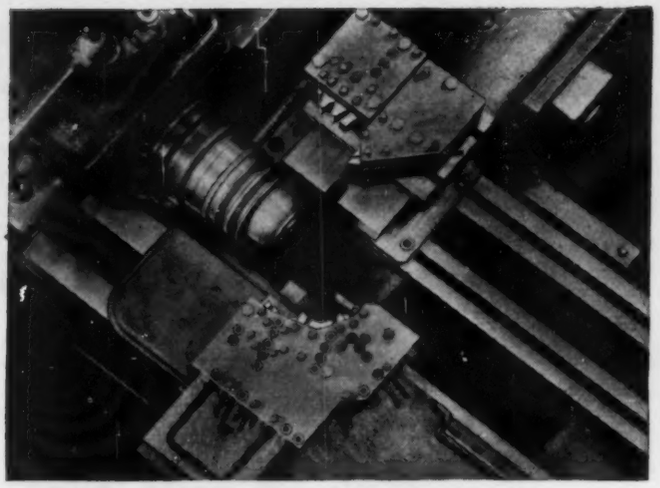
Turning Cast Iron Crank with Turret Type Tool Block This standard Sundstrand Model 10 Automatic Lathe is provided with a turret-type tool block mounted on the front slide. This facilitates rough and finish turning on the main diameter of the crank. Machine is cycled twice to obtain the rough and finish cuts with manual indexing of the turret between each cut. This same machine with additional tooling is used to turn, face and form a number of other parts including pulleys, spacers, and pistons.

How to-

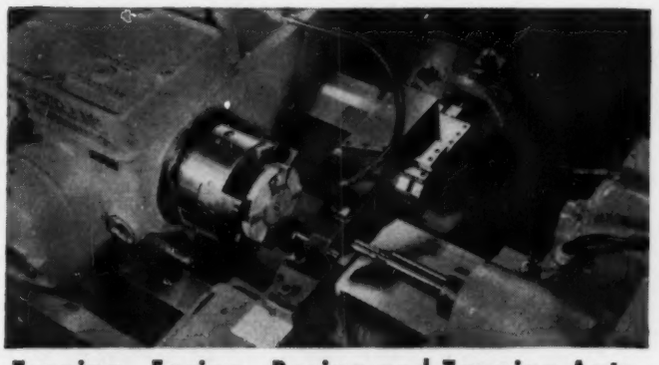
LOWER TURNING COSTS

This 44 page booklet, crammed full of technical data and production information, shows how to apply multiple tooling to countless turning jobs. Short-run, mass production and special turning jobs are all included. Write for your copy today. Ask for bulletin 175.





14 T. C. Tools Turned This Job in One Operation Here is an excellent example of multiple tooling on a high production job. Facing, turning, grooving and boring operations are performed in one automatic cycle on this pulley. The 14 tools used in this set-up can be reset easily to handle various sizes of parts. The machine is standard, and tooling can be replaced to handle many other types of turning jobs.



Turning, Facing, Boring and Tapping Automatically This application of multiple tooling combines front and rear slides tooling with a special tapping unit attached to the base. This facilitates the combination of facing, boring and tapping automatically in one machine cycle. The part is an electric motor flywheel, and this one machine produces the equivalent of two machines and two operators formerly used for this work.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

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TURN IN MORE SCRAP!

HERE'S WHAT YOU CAN DO TO HELP RELIEVE THE SCRAP SHORTAGE

1. Put some one individual in charge of scrap in all departments of your business and GIVE HIM AUTHORITY TO ACT.

2. Comb the plant and yards for dormant scrap, abandoned equipment, old boilers, pipe, moulds, obsolete dies and parts, material now wasting away which has salvage value.

Survey all plant equipment, particularly idle stand-by or discarded machines, with a view to scrapping all not convertible to useful production.

Consult your scrap dealer for advice on types, grades and sizes.

3. Segregate each class of scrap and supervise its handling to avoid contamination. This will increase its value. Identify, classify and provide separate containers, clearly marked, for each class of scrap material.

Dismantle discarded equipment promptly into its components—electrical, fastenings, lumber, etc.—so that these parts may be utilized or scrapped.

Sort sweepings and miscellaneous waste to recover scrap values.

4. Constant reminders in the form of posters, illustrations of right and wrong methods, pay envelope enclosures, house organ publicity, etc., are potent aids to the scrap recovery program.

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MORE SCRAP—MORE STEEL
Move your scrap to the mills—
Sell it...ship it...move it now!

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3 New Veeder-Root COUNTERS

Series 1260 General-Purpose Counter: Rich, modern, 2-tone gray. Veeder-Root "Ease-Eye" Reading Line of 6 bold figures. Reset. Adaptable to any standard drive, from either side.

Series 1248 Magnetic Counter: For remote indication, as from plant machines to central panel in office. 2-tone gray with "Ease-Eye" Direct Reading Line of 6 figures. Smaller size to fit more built-in installations. AC or DC. Reset.

Series 1268 Magnetic Counter: Record-breaking low cost for Veeder-Root quality. Meets the limited specifications of certain installations not requiring an extremely high number of accumulated counts, or high speeds, because of nature of the customer's equipment, like coin machines.

. . . the like of which you never saw before!

MODERN ENGINEERING IN MODERN DRESS . . . that's what you get in these new *and newsworthy* Veeder-Root Counters for electrical and mechanical operation.

Look where you will — there's nothing like these counters for streamlined design . . . smart color-contrasts . . . ease of *direct* reading . . . speed of operation . . . and, above all, *adaptability* to a wider range of products into which these counters can be built as original, integral parts.

See how easily they can be built into *your* product . . . and how powerfully they'll help build up your sales. Write.

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Today, thousands and thousands of Reliance V★S Drives, providing *adjustable speeds from A-c. circuits,* are helping to increase production and reduce costs in every industry. These completely packaged, all-electric drives have become so popular since they were first introduced ten years ago that there is now no important industry where they are not being profitably employed. If you do not yet have the proved time-saving and cost-cutting advantages of Reliance V★S Drive in your plant, it will pay you to investigate further. Write for *new* Bulletin 311!

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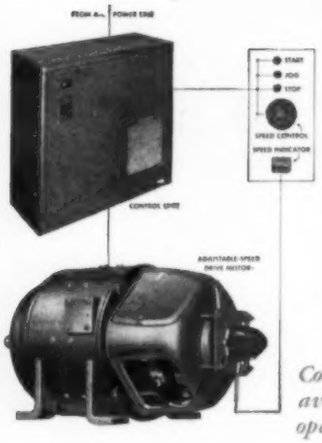
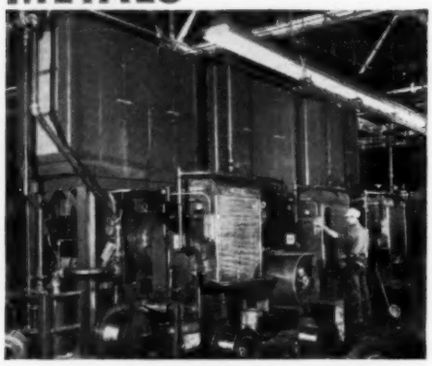
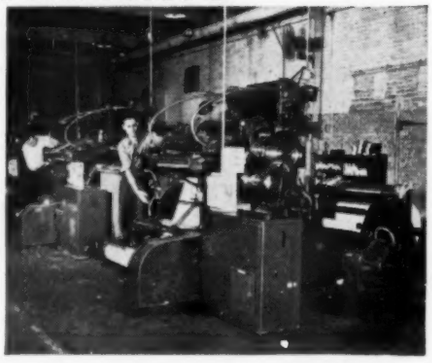


Conveniently-packaged, factory-wired V★S Drives are available from 1 to 200 hp. Two or more motors may be operated simultaneously from a single Control Unit.

METALS



PRINTING



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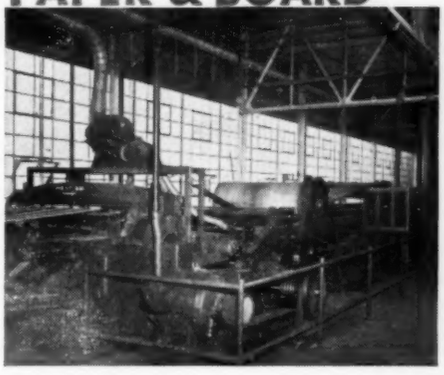
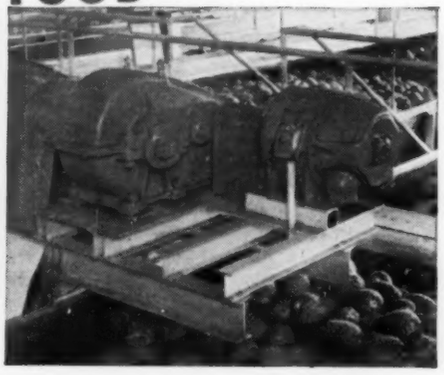
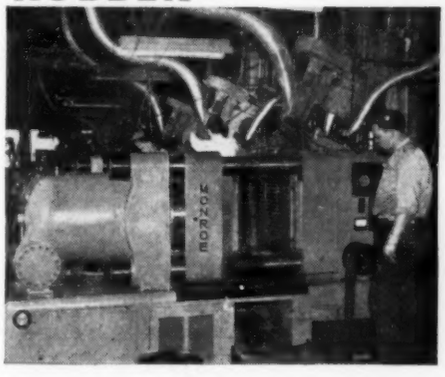


TEXTILE

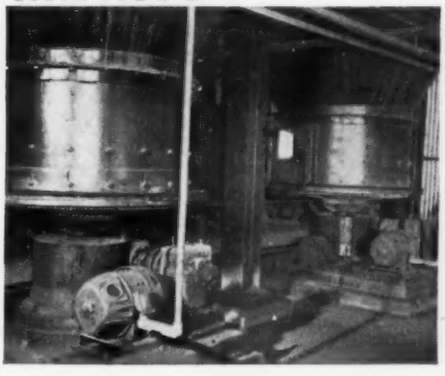
FOOD



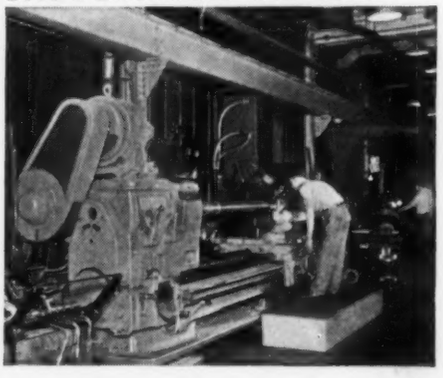
RUBBER



MINING



MACHINE TOOL



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NEW! 7½ H. P. SPINDLE DRIVE

No. 12 PLAIN MILLING MACHINE

The advance design of this new Brown & Sharpe Modern Production Tool fills a demand for more efficient, cost-saving milling in the medium-size work field. Longitudinal table feed, 24". Transverse adjustment of spindle, 4". Vertical adjustment of spindle head, 10¼". Full electrical controls make operation easy, safe, flexible. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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MORE POWER • • • FULL 7½ H. P. TO SPINDLE

Here's a compact, versatile, manufacturing-type milling machine, similar in many ways to the 3 H.P. No. 12, but specifically powered for heavier cuts, and of ample capacity for many moderate-sized carbide milling jobs. Its power is applied through a separate spindle motor to give maximum effective cutting capacity and economy.

BROAD CHOICE OF SPEEDS AND FEEDS

21 spindle speeds, from 25 to 1790 r.p.m. in either direction (24 intermediate speeds also available) —plus 28 separate rates of *feed*, from ½" to 35" a minute. This provides more-exact selection for better adaptation to the characteristics of materials . . . and permits the most efficient milling cycle.

Other Outstanding Features

CLIMB MILLING in either direction is permitted by a built-in backlash eliminator on the table screw—released automatically during fast travel (300" per minute).

DUAL TABLE-FEED RATES (automatically or manually controlled) provide 16 feed rates from ½" to 17½" per minute which may be automatically doubled at any desired point in cutting feed, or 16 rates, from 1" to 35", which may be automatically halved . . . thereby reducing the length of the milling cycle.

AUTOMATIC REVERSE IN CUTTING FEED, with table continuing in cutting feed in opposite direction, permits rough and finish milling at one loading of work, using dual feed rate if desired.

DOUBLE FIXTURE MILLING with one set of cutters . . . conventional milling on one end, climb milling on the other . . . makes cutting practically continuous.

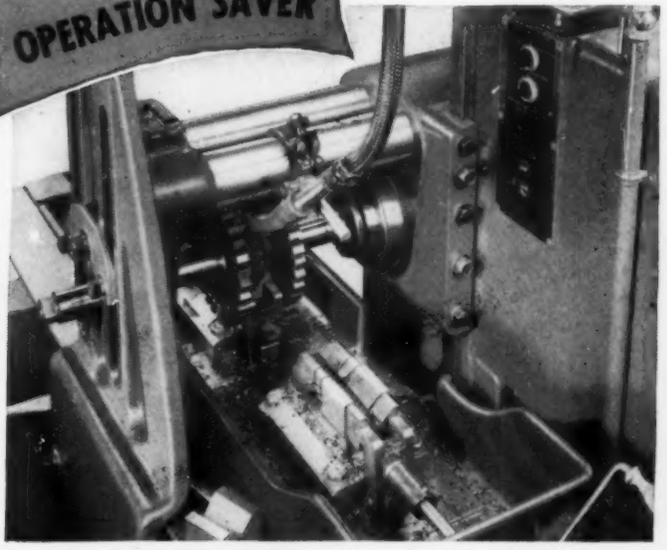
This method is extremely efficient for many classes of work.

Typical Applications

TIME SAVER

Climb milling with formed cutters simplifies this job, permitting high production, accuracy and good finish. Climb milling frequently makes possible faster feeds than with conventional milling and gives longer cutter life between sharpenings.

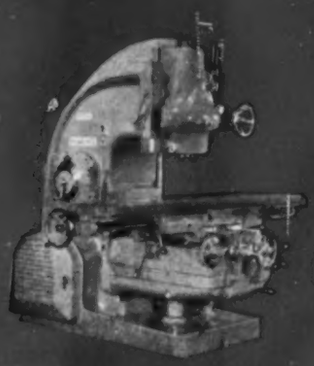
OPERATION SAVER



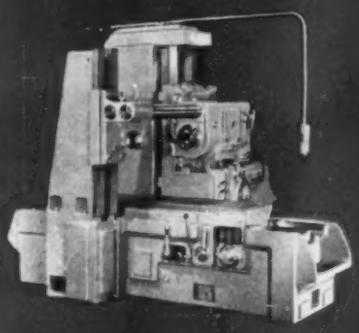
Continuous double-fixture milling, using automatic milling cycle, automatically repeated, eliminates loading time. Ample power allows several cuts to be combined in one operation—saving additional set-ups and handling.

SHARPE B·S

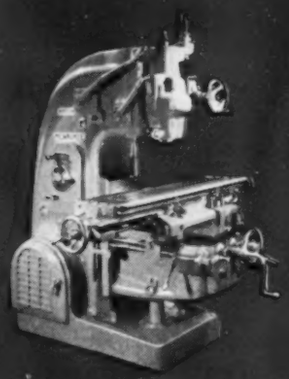
When selecting any machine tools **Choose From**



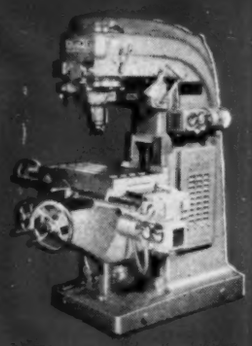
Model 4K Vertical — The largest of the famous "K" machines — also available in Plain and Universal styles, with Automatic Cycle Control on Plain and Verticals.



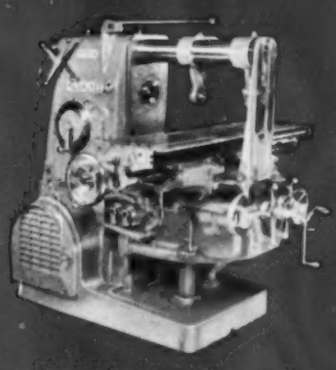
Model CSM Simplex — Massive new concept in bed-type milling machines wide working ranges and horsepower capacities for best use of all cutters.



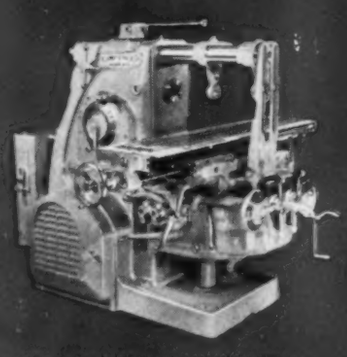
Model 2H Vertical Automatic Cycle — A very popular size machine — also available in Plain Automatic Cycle and in Plain, Universal and Vertical styles.



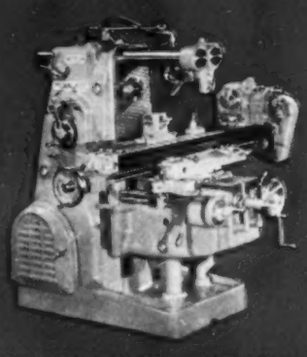
Model 2D Rotary Head Milling Machine — Extremely versatile and cost-reducing — especially suited to all kinds of precision tool, die, and production work.



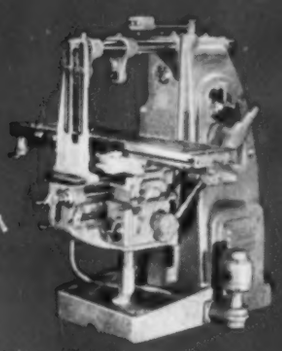
Model 3K Plain — The popular medium size in the famous "K" line — available in Plain and Vertical Automatic Cycle and in Universal and Vertical styles.



Model 20 CSM Plain Automatic Cycle — Also available in Vertical Automatic Cycle and Plain, Universal and Vertical styles. A big No. 2 machine.

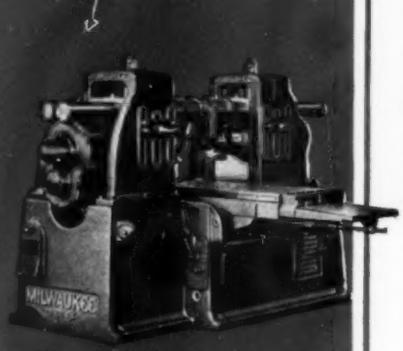


Model 2H Universal — the most popular size machine incorporating every precision refinement for fast, low-cost production as well as tool room purposes.



Model 2E Plain — Simplified design in size ideal for most shop purposes. Gives real economy in small part production — best dollar-for-dollar investment.

Model M-24 Simplex — High-speed, light class, production type machine — available with either 18", 24" or 30" longitudinal table travel. Simplex models only.



Model 1800 Duplex—High-speed, medium size, production type machine — also available in Simplex models. Choice of 24", 36" and 54" longitudinal table feed.

WHAT ARE YOUR NEEDS?

The Kearney & Trecker line of Milling Machines and Precision Boring Machines offers you literally *hundreds* of different working combinations. You can be certain that your specific job requirements can be accommodated, no matter whether they involve:

1. **Size or Type of Machine**
2. **Machine Working Ranges**
3. **Horsepower Capacities**
4. **Dual Spindle Speed Ranges**
5. **Automatic Cycle Table Control**
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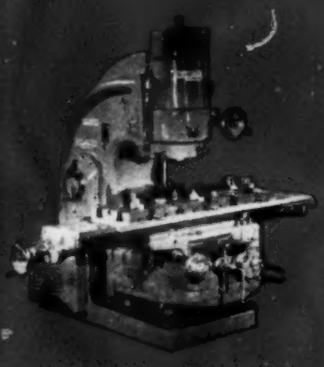
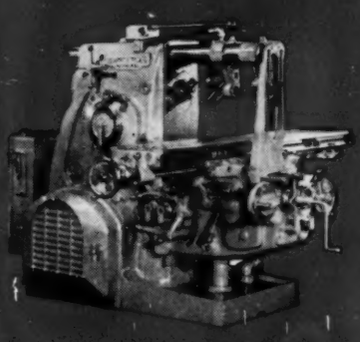
7. **Broad Feed and Speed Ranges**

THE KEARNEY & TRECKER LINE IS COMPLETE!

the First Choice Line!

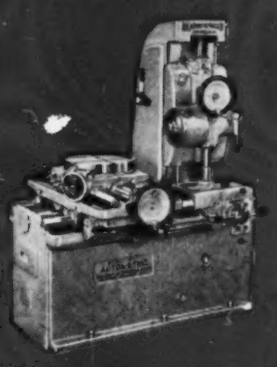


Knee type milling machine with Built-in Chucking Type Table — available in Nos. 2, 3, 4 and 5 sizes — Reduces set-up time up to 50% — saves fixture costs.



Duo-power milling machines provide two different spindle speed ranges in one machine, offering a wide range to accommodate the many cutting tool materials.

Model 5H Plain — The largest of the "H" line. — also available in Universal and Vertical styles and in Plain and Vertical styles with Automatic Cycle Control.



Model 2B Autometric Precision Boring Machine — for economy and precision. Built-in Rotary table handles work on several sides of workpiece with one set-up.

Kearney & Trecker Machine Tools Increase Your Production, Improve Your Precision, Reduce Your Costs

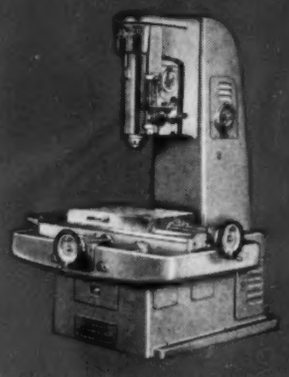
YOU'RE LOOKING at but 15 machines from the world-famous line of Kearney & Trecker milling machines and precision boring machines. Actually, this great line offers you over 250 different sizes, types, working ranges and horsepower capacities from which to select the exact machine you need.

If your problem involves milling or precision boring—there's a Kearney & Trecker machine to solve it. Model K machines are general all-purpose units; Model H machines are intermediate types. The CSMs are powerful knee types that use both H.S.S. and carbide cutters to maximum advantage. For high speed production, there are standard manufacturing types and standard knee types with single lever Automatic Cycle Table control. For unusual work-holding problems there are 36 machines with the new Built-in Chucking Type Table.

What's more, you'll find a wide choice of big machines with a variety of working ranges and horsepower capacities in the new CSM Simplex and Duplex bed types. For specialized toolroom or shop applications, there's the Model 2D Rotary Head milling machine and the Autometric Precision Boring line.

Kearney & Trecker offers a Customer Engineering Service where you can use the help of 50 years' experience in precision and production machine tool design and manufacture.

Write today for complete information on any one or all machines—or contact your nearest Kearney & Trecker dealer or branch office. No obligation. Kearney & Trecker Corporation, Milwaukee 14, Wisconsin, U. S. A.



Model 3C Autometric Precision Boring Machine — large size vertical type machine — incorporates every refinement needed for 3-dimensional accuracy.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

An Announcement . . . . . .

The Giddings and Lewis Machine Tool Company is pleased to announce the purchase of

The Cincinnati Planer Company,

manufacturers of the CINCINNATI HYPRO line of Double Housing and Open Side Planers, Vertical Boring Mills, and Planer Type Milling Machines.

The skills and knowledge of both companies, now combined, will give even greater service to the users of heavy machine tools.

GIDDINGS AND LEWIS MACHINE TOOL COMPANY

Fond du Lac, Wisconsin, U. S. A.

High Power Precision Horizontal Boring, Drilling and Milling Machines with spindle sizes from 2½″ to 10″ in diameter, and in table, planer, floor and multiple head types. Also a complete line of attachments and accessories.

GIDDINGS & LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN

Davis Boring Tools and Boring Tool Sets for Horizontal Boring, Drilling and Milling Machines, Turret Lathes, Radials and special machine applications. Car Wheel Boring Tools for Railroad Shops.

DAVIS BORING TOOL DIVISION of
GIDDINGS & LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN

The CINCINNATI HYPRO line of Double Housing and Open Side Planers, 24″ to 144″; Vertical Boring Mills, 54″ to 12′ - 20′; Planer Type Milling Machines, 30″ to 120″; and also combined Planer-Millers.

THE CINCINNATI PLANER COMPANY
CINCINNATI 9, OHIO

Corporate entity of The Cincinnati Planer Company will be retained and it will continue to operate at Cincinnati as a wholly-owned subsidiary of the Giddings and Lewis Machine Tool Company.

If you're having tap trouble, there's a reason and a cure

The *right* tap shouldn't fail. Tapping, above all things, should be trouble-free. If there's one part of the craft of metalworking that this country knows well — if there's one operation that's been done and redone, time and time again, in every kind of metal known to man — it's putting a thread in a hole.

We think that's the very *reason* some shops still have tapping troubles. Taps are taken for granted . . . bought casually, and with little planning.

That can be fixed. Pratt & Whitney can supply the standard or special taps you need — not offhandedly, but with real respect and understanding of the job. If you let Pratt & Whitney's tap engineering service analyze your various jobs and recommend the tap design *and* tapping procedure, your tapping worries will vanish.

For the *right* tap shouldn't fail.

We know what we're talking about. Ask for proof.

PRATT & WHITNEY
***Division* Niles-Bement-Pond Company**
West Hartford 1, Conn.

Pratt & Whitney Tap Engineering

P&W Taps include all types and sizes

P&W Taps contain only top-quality steel made to our exact metallurgical specifications and subject to rigid P&W metallurgical department inspection. This top quality is maintained in tap design . . . heat-treatment . . . finishing . . . inspecting . . . to insure the best in Tap Quality for your use. P&W Taps and quality are synonymous.

"There is no better-paying investment than the right tools for the job"

Pioneer manufacturers
of Automatic Turret Lathes

Fast two-operation machining of Bearing Quills on a P&J3U SPEED-FLEX

The job illustrated and described here, gives an excellent idea of the possibilities of the new 3-U SPEED-FLEX Automatic Turret Lathe designed especially for handling small chucking work at fast production rates. It is specially tooled to complete the machining required in two operations. Average floor-to-floor time for the first operation is 1.22 minutes; second operation is performed in 1.47 minutes. Work is chucked in one position for the first operation and in another position for the second operation. One operator can readily handle several machines.

This outstanding performance of the 3-U Speed-Flex is being consistently duplicated on a wide range of other small chucking work, conclusive evidence that Potter & Johnston has met an urgent need for a high speed machine of this type and capacity. If you have a problem involving the low-cost production of small duplicate parts, ask P&J Methods Engineers for recommendations.

DETAILS OF JOB

Part: Bearing Quill

Material: Grey Iron

Method and Operation:

(1st Operation)

Presenting hub side to spindle grip on flange with 3 chuck jaws.

Machine as follows:

1st T.F.: Rough bore 2¼" dia.; face one side of flange.
2nd. T.F.: Finish the above cuts; chamfer where necessary.

(2nd Operation)

Presenting flange side to spindle grip in 2¼" dia. hole with 3 chuck jaws.

Machine as follows:

1st. T.F. Rough bore 2.4995"; rough face flange turn 3.562" dia.; face end; turn O.D. of flange.
2nd. T.F.; Finish the above cuts; chamfer.
3rd. T.F.: Ream 2.4995" dia.
4th. T.F.: Size turn 3.562" dia. and 4.937" dia.

Pieces per hour (1st Operation): 41.5
Pieces per hour (2nd Operation): 34.8

POTTER & JOHNSTON COMPANY
PAWTUCKET, R. I.
Subsidiary of
PRATT & WHITNEY
division Niles-Bement-Pond Company

ARMSTRONG

ARMSTRONG TOOL HOLDERS

are more efficient

It takes years of development, improvement and practical experience to create and perfect a line of tools. This has been the specialized work of ARMSTRONG, a contribution to machining efficiency which they have carried on continuously for 59 years.

Starting with the Armstrong Principle of inserted cutters in permanent tool shanks that "Saves: all Forging, 70% Grinding and 90% High Speed Steel," they created this unique method of tooling which has changed shop practice in over 96% of the machine shops and tool rooms. And, today, in a specially built plant, equipped with every modern facility and staffed with experts in each phase of tool making, this work goes on.

To you, as a tool user, here is always one safe principle—specify ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters and shapers, for turret lathes and screw machines. They are cataloged and stocked by all leading supply houses.

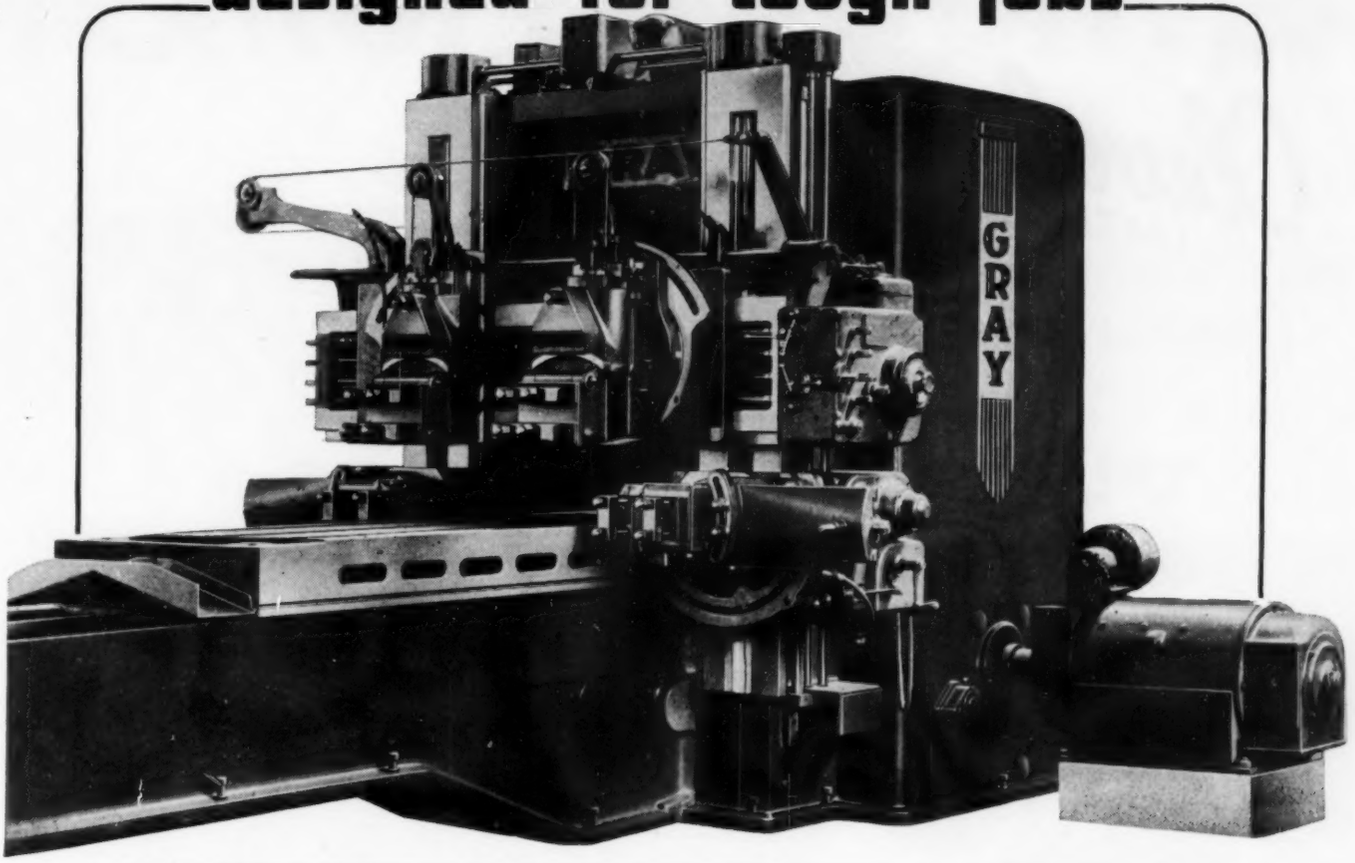
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVE. CHICAGO 30, U.S.A.

Eastern Whse. & Sales Office: 199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. & Sales Office: 1275 Mission St., San Francisco 3, California

designed for tough jobs



GRAY die-block PLANERS

Here is the planer for your production of hard, tough die-blocks. This Gray Planer was specifically designed for these jobs. It will face, side plane, and shank die-blocks, in the minimum time. All heads are swivel type, equipped with tool lifters, have power feed, rapid traverse. 50 to 100 H. P. motors.

Write for Bulletin No. 49

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.

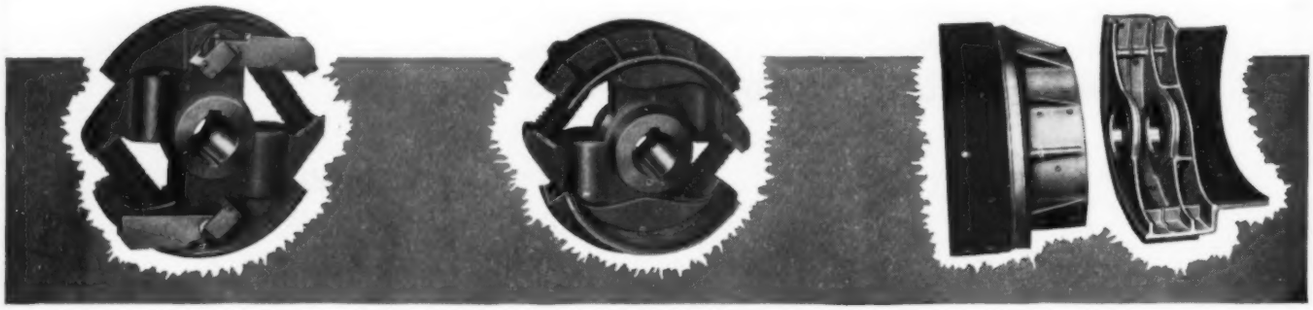
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

THIS Cleveland (PATENTED) DRUM TYPE CLUTCH

is now available for practically every TYPE, SIZE AND MAKE of Mechanical Power Press

If you are considering the installation of new Power Presses and are interested in uninterrupted production, it will pay you to investigate the advantages of using **CLEVELAND PRESSES** equipped with the new (patented) **Drum Type Air Friction Clutch** which is not only different in design and construction but, of more importance, **different in performance.**

Therefore, if you are interested in obtaining additional information on this **Cleveland Drum Type Clutch,** in connection with new Power Presses, or for installation on Presses now in use, we suggest that you furnish us with details as to the **type, size,** (and **make**) of Press, and the information you desire will be furnished promptly.



This shows a view of the Clutch with the flywheel removed. The Clutch which has the linings on the outer part of the shoes, engages the flywheel through air operated pistons connected to the Clutch by means of levers.

This shows the opposite side of the unit, with the brake linings on the inside of the shoes. The spring loaded positive brake brings the machine to an immediate stop after each stroke of the slide and also in the event of failure of the electric current or air supply.

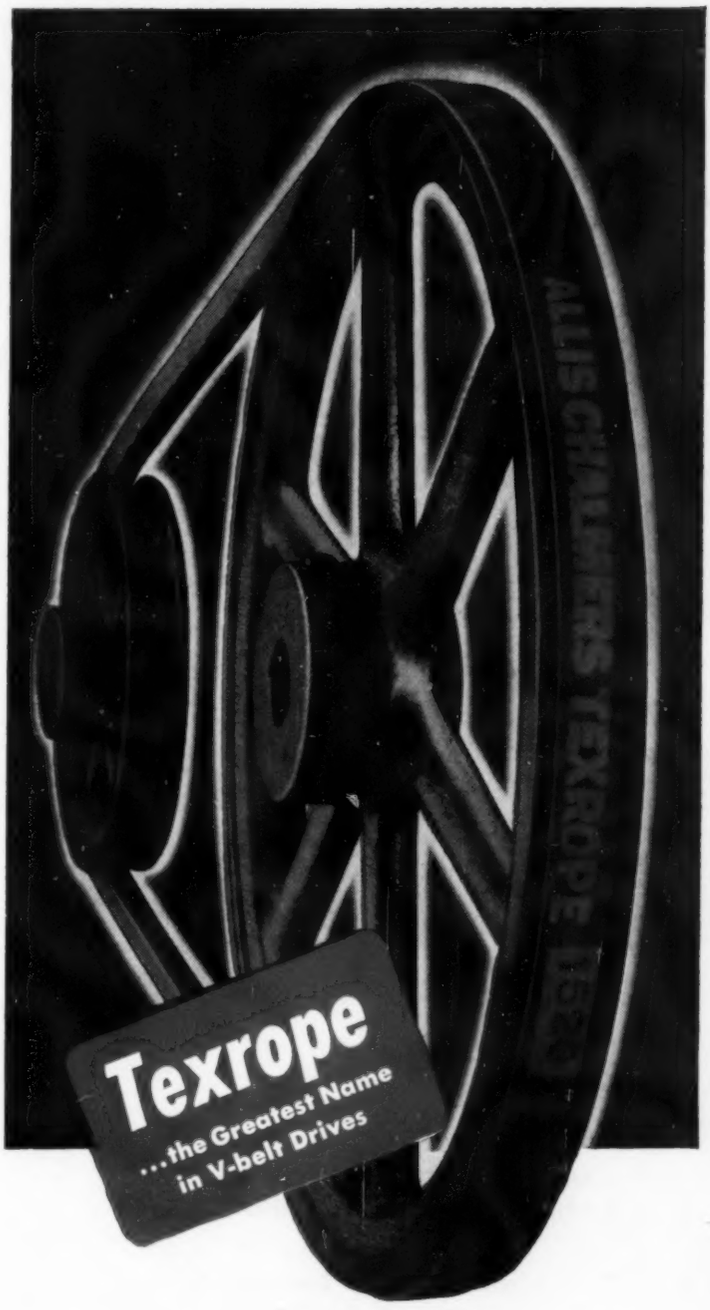
The Clutch and Brake is a combined unit of one piece construction and cannot become separated or engaged simultaneously.

THE CLEVELAND PUNCH & SHEAR WORKS CO.

District Offices
NEW YORK · CHICAGO · DETROIT · PHILADELPHIA · PITTSBURGH

Cleveland 14, Ohio

TEXROPE F/HP Drives



- **"ENGINEERED" FOR INDUSTRY!**
- **AVAILABLE NOW!**
- **CARRY THE NAME "TEXROPE"... AND OVER 25 YEARS OF EXPERIENCE!**

IF YOU'RE IN THE MARKET for fractional horsepower V-belt drives, here are good reasons for investing in TEXROPE — the greatest name in V-belt Drives. 1) They're "engineered" — selected and applied to suit the exact characteristics of your drive. 2) They're in stock at Authorized A-C Dealers or available promptly through A-C District Offices, and 3) They're backed by the greatest collection of V-belt drive experience and facilities of any company in this business.

TEX-IRON F/HP SHEAVES

High density cast iron. Accurately bored for easy fit with tight shaft grip. Precision grooved for non-slip power and longer belt life. Carefully balanced for vibrationless operation at all speeds.

TEXROPE F/HP V-BELTS

Best known name in V-belts. Carry full rated load with plenty of overload and shock load capacity. Molded to fit sheave groove and grip tightly without excess wear or wasted power. An ideal teammate for Tex-Iron sheaves. Highly efficient on present sheaves, too.

The complete range of Tex-Iron sheaves from 2 to 15 inches PD and Texrope V-belts to match are now available from your dealer's stock. Call him today. Texrope, Tex-Iron, Super 7, Texsteel, Magic Grip and Vari-Pitch are Allis-Chalmers Trademarks. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 2510

A Complete Range of Products

Super-7 V-belts	5 types . . . sizes to suit every power transmission job	
Texsteel, Texdrive, Magic-Grip	Sheaves in a full range of sizes and grooves	
Vari-Pitch Sheaves	Exact variations in speed — Stationary or Motion control	
Speed Changers	Speed variations up to 375% at the turn of a crank	

SEND TODAY for Allis-Chalmers 44 page book No. 2086249A describing Texrope F/HP V-belt drives — the Fractional Horsepower Drive that's "Engineered" for Industry. Result of years of experience in engineering FHP V-belt drives. Shows you simple, accurate way to select FHP sheaves and belts. Every FHP drive user should have a copy.

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS

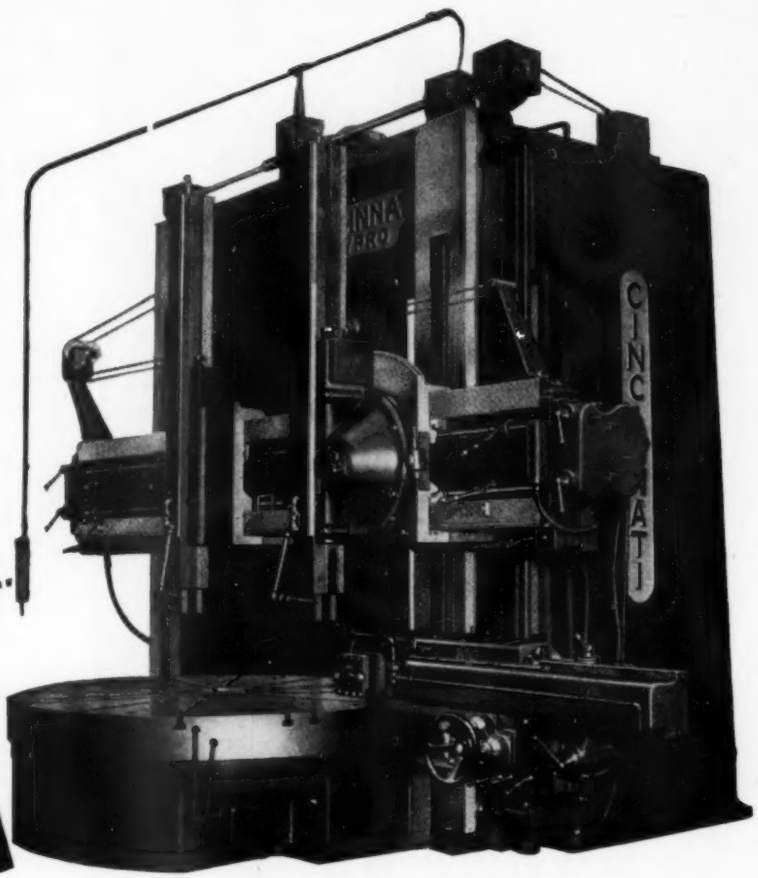
Originators of the Multiple V-belt Drive for Industry

FINE INCREMENT SPEED CONTROL—Multi-point, fine increment motor rheostat controlled from operators position, eliminates compromise speed settings, inevitable with conventional gear changes. Exact cutting speed assures maximum production.

TAILORED TABLE SPEEDS—On work of varying diameter table speed may be continuously adjusted for maximum production, without stopping table, without shifting gears and while tools are cutting.

SET UP TIME REDUCED—Fine increment table inching control in forward and reverse directions with dynamic braking.

OPERATOR'S FATIGUE ELIMINATED — Complete control of all motors from single accessible pendant station, plus absence of table clutch and brake shifting lessens operator's fatigue.

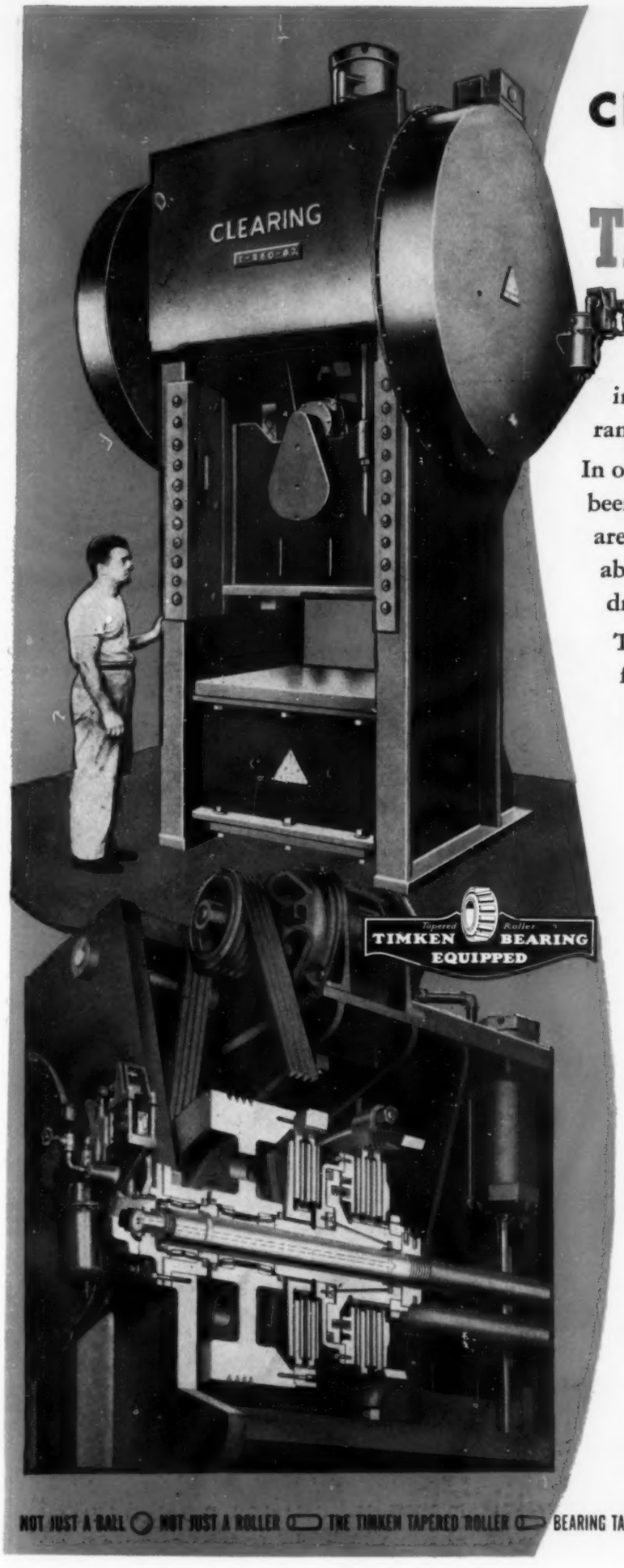


Effortless Control
COMES WITH
CINCINNATI
HYPRO
SPEED CONTROL

CAN NOW BE FURNISHED ON ALL HYPRO BORING MILLS IN FOLLOWING SIZES:

54"—64"—6'—7'.
7' widened to 8'. 8'—10'—12'.
12'—16' Extension type.

THE CINCINNATI HYPRO PLANER COMPANY
PLANERS · BORING MILLS · PLANER TYPE MILLERS
CINCINNATI, OHIO



NEW LINE OF CLEARING PRESSES INCORPORATES TIMKEN® BEARINGS

Representing various departures from previous designs, the new line of Clearing straight-sided presses comprises capacities ranging from 60 to 250 tons.

In one important respect however, no change has been made. Timken tapered roller bearings still are definite factors of performance, dependability and economy, being applied on the drive shaft and in the flywheel as illustrated.

The result is smooth, well-balanced operation; full capacity for radial, thrust and combined loads; correct and constant alignment of parts; reduction of wear; simplicity of lubrication; economy of power; greatly reduced maintenance.

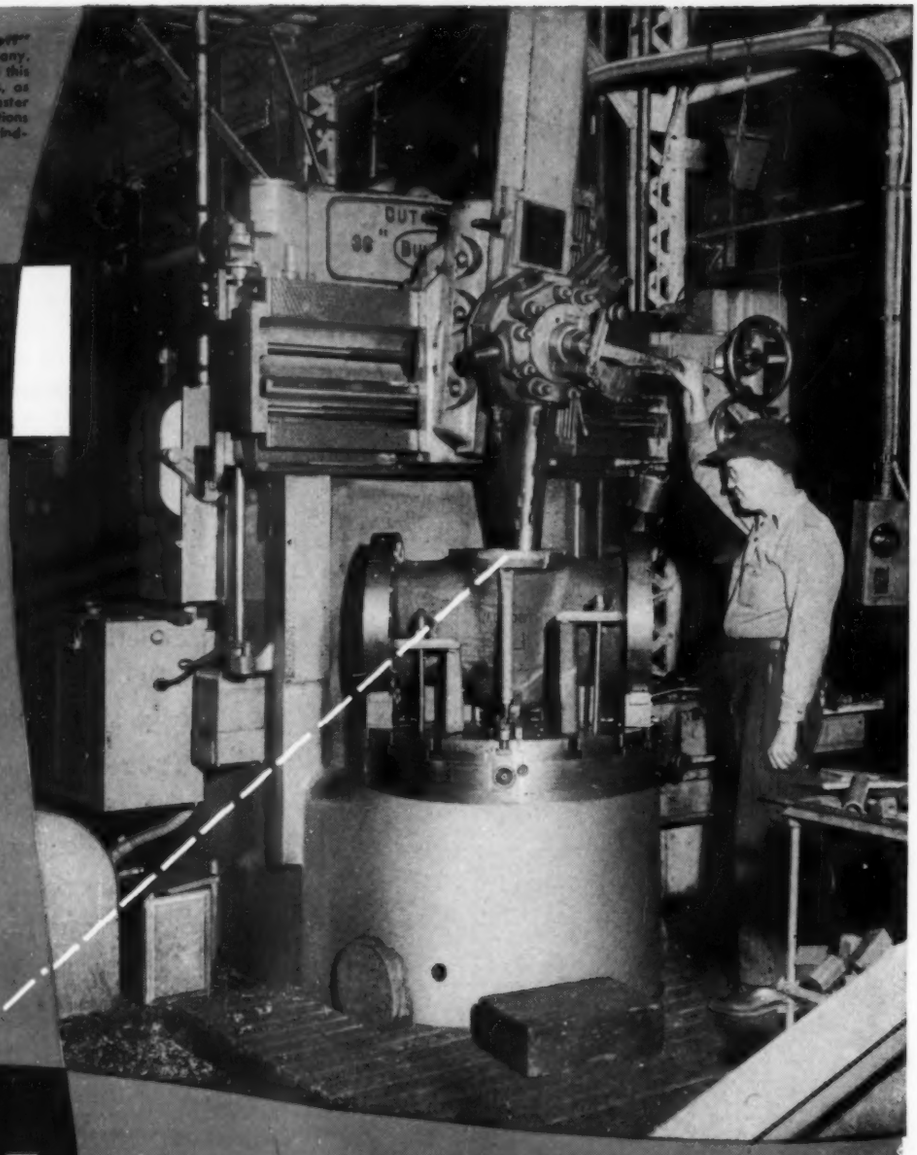
Clearing Machine Corporation has used Timken bearings for many years; knows they can be relied on to deliver long, trouble-free service — and so do their customers.

Specify "Timken Bearing Equipped" in the machines you buy. Look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address "Timrosco".

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ↕ AND THRUST →⬭← LOADS OR ANY COMBINATION ✳

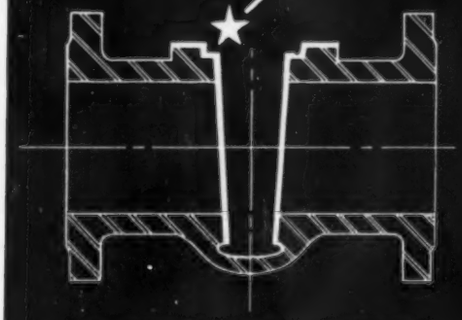
This BULLARD 36" Cut Master is "really paying off" at Newport News Shipbuilding & Drydock Company. Here you see it taper boring a large valve. On this job, it also faces the flange and counter bores, as shown on the cross-sectional drawing. The Cut Master not only saved 33⅓% on these three operations but also provided such a smooth finish that a grinding operation was eliminated.



PERFORMANCE REPORT FROM NEWPORT NEWS SHIPBUILDING & DRYDOCK COMPANY

CUTS COSTS 2 WAYS ON CAST STEEL VALVES with a 36" BULLARD Cut Master

1. SAVED 33⅓% ON 3 OPERATIONS
2. ELIMINATED A GRINDING OPERATION



Cross sectional drawing of valve with heavy lines indicating machined surfaces.

You, too, can expect savings on most of your jobs. It's easy to see why: The bed is cast in one heavy, rigid piece. Spindle is firmly supported top and bottom by large Timken roller bearings. Screw feeds provide and maintain a high degree of machining accuracy.

OTHER COST-CUTTING ADVANTAGES

Because the BULLARD Cut Master was designed specifically to save time on and between cuts, you find other unique features. The rapid and positive speed selection with the BULLARD pendant type control, limit-stops for simplified dimensional duplication, and centralized operating controls speed up operations and conserve costs. For complete description of these and other distinctive features, as well as data on feeds, speeds and sizes, write for Bulletin CVTL-4-1 today.

THE BULLARD COMPANY, Bridgeport 2, Connecticut.

BULLARD

BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

27% more holes per grind

with this CLE-FORGE stock drill

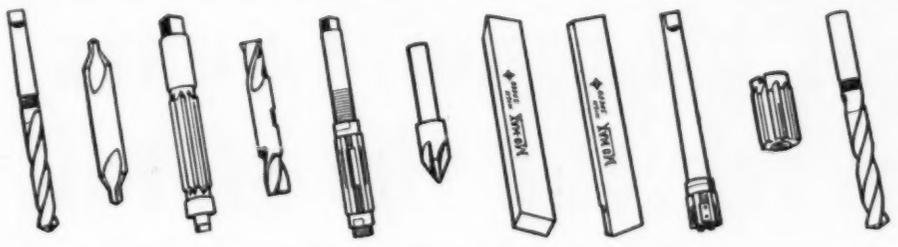
Gives Big Increase in Performance

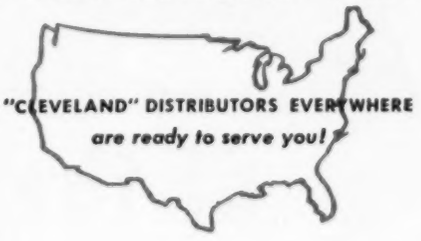
● CLE-FORGE High Speed Drills had been giving good performance on this job—drilling holes 1¾" deep in cast iron at 80 f.p.m., with an average of 245 holes per grind. ◈ One of our Service Representatives, however, believed that even better results could be obtained by using another type of CLE-FORGE High Speed Drill (also a stock item). By following his recommendation *the average number of holes per grind was increased to 312.* ◈ *Cleveland* Service Representatives are trained to help you increase your production and reduce your costs. Contact our nearest Stockroom, or . . .

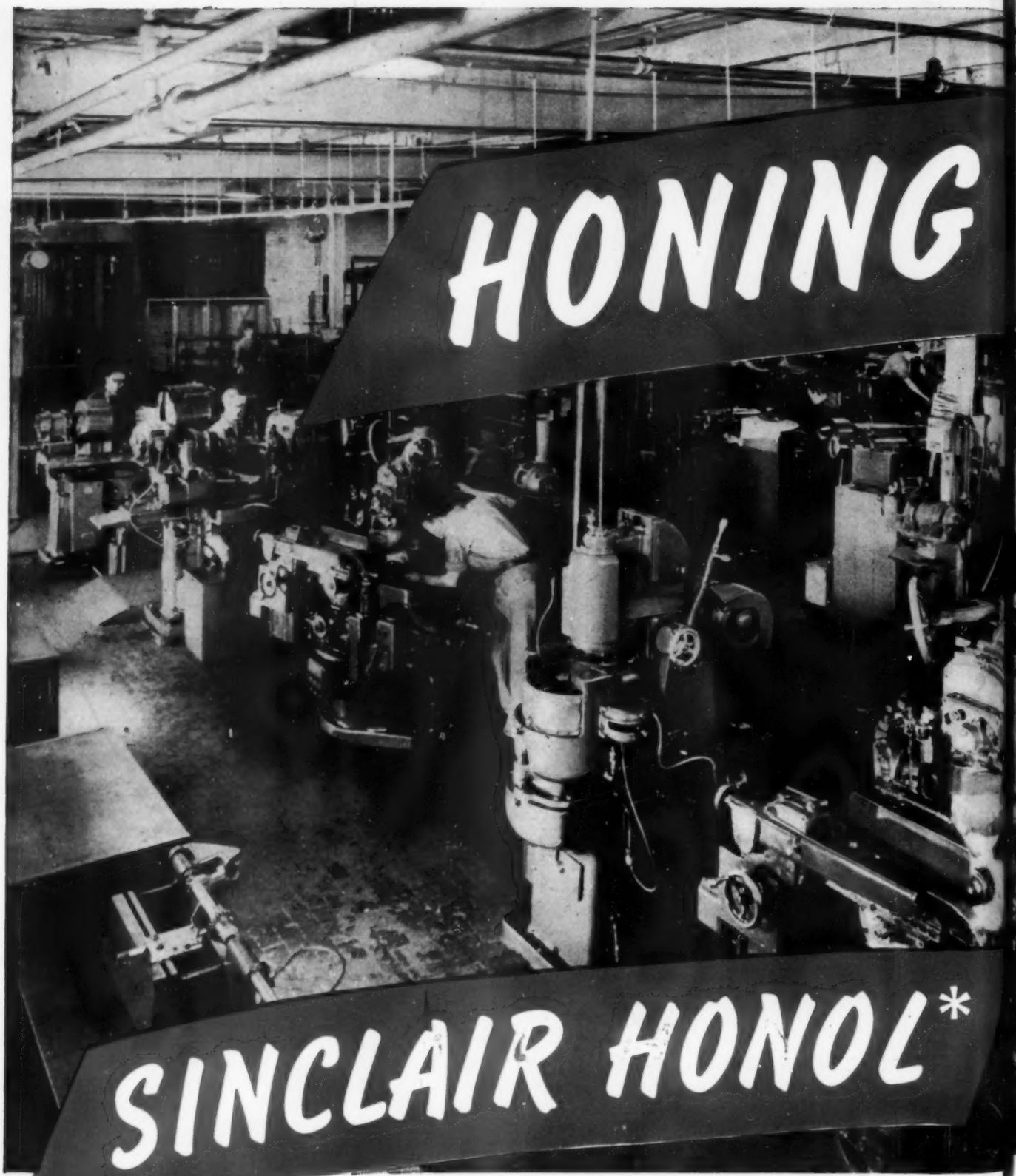
Telephone Your Industrial Supply Distributor.

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street **Cleveland 14, Ohio**
Stockrooms: **New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5**
Los Angeles 11 • London W. 3, England

ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER CLEVELAND TOOLS

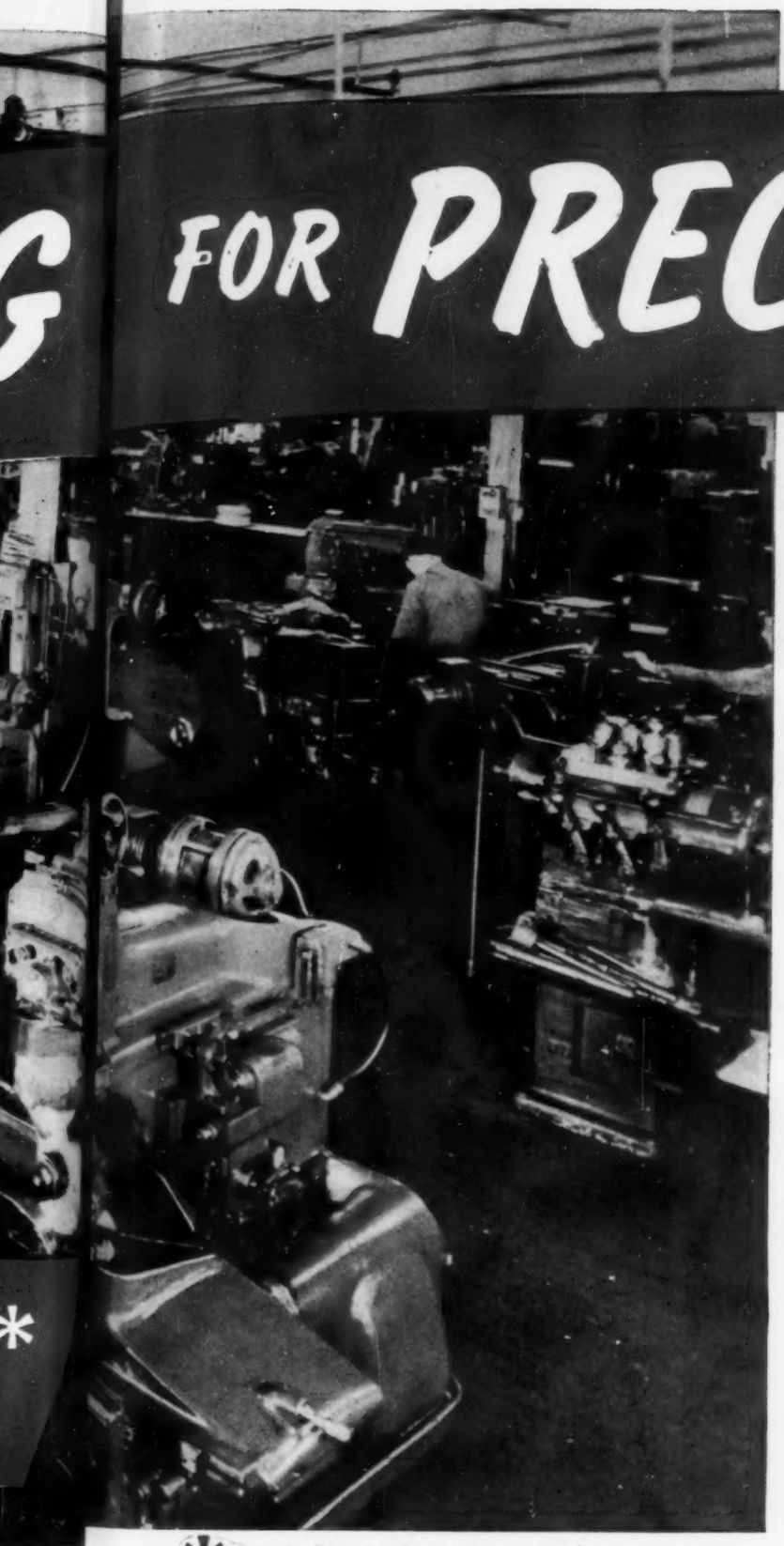






...meets all requirements of the work and the metal

FOR PRECISION



Choice of coolant is vitally important in honing. It is second only to the proper grit or grade of the abrasive stone.

Sinclair HONOLS are made to meet the requirements of both work and metal. They come ready for use; they need no further mixing.

Sinclair consultants, skilled in honing operations and application of appropriate coolants, are available to advise you on the proper grade of HONOL to insure precision finish and uniformity of results.

* Honing Fluid, Reg. U.S. Pat. Off.

SINCLAIR

INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE
SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

SUPERMETRIC

TRADE-MARK

The ground thread chaser with the *Superior Finish!*

Here is Geometric's newest development in chasers, with the threads, keyways, cam lug slots and other surfaces finished to a much higher degree of precision and smoothness than heretofore obtainable. Completely new manufacturing methods make this possible and at the same time enable us to market this product at moderate cost.

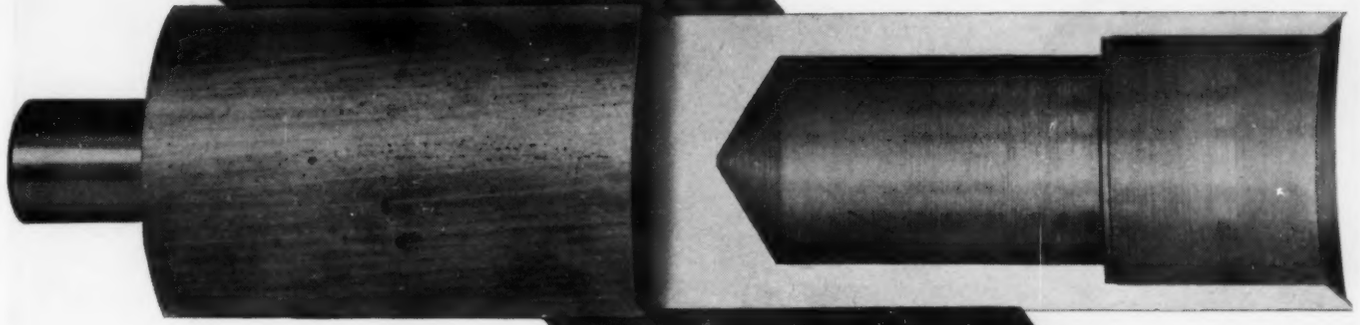
If you want a chaser that will produce threads to closer limits and give longer life, "SUPERMETRIC" is the answer. Made in both regular and projection types, "SUPERMETRIC" Ground Thread Chasers are now available in all National Standard thread sizes for the ⅝" Styles DS and DJ Geometric Die Heads. Sizes for other Geometric Die Heads are now being developed.

For further information, write us, ask your nearest "Geometric" representative, or better still, order a few sets and try them. We know you'll buy more.

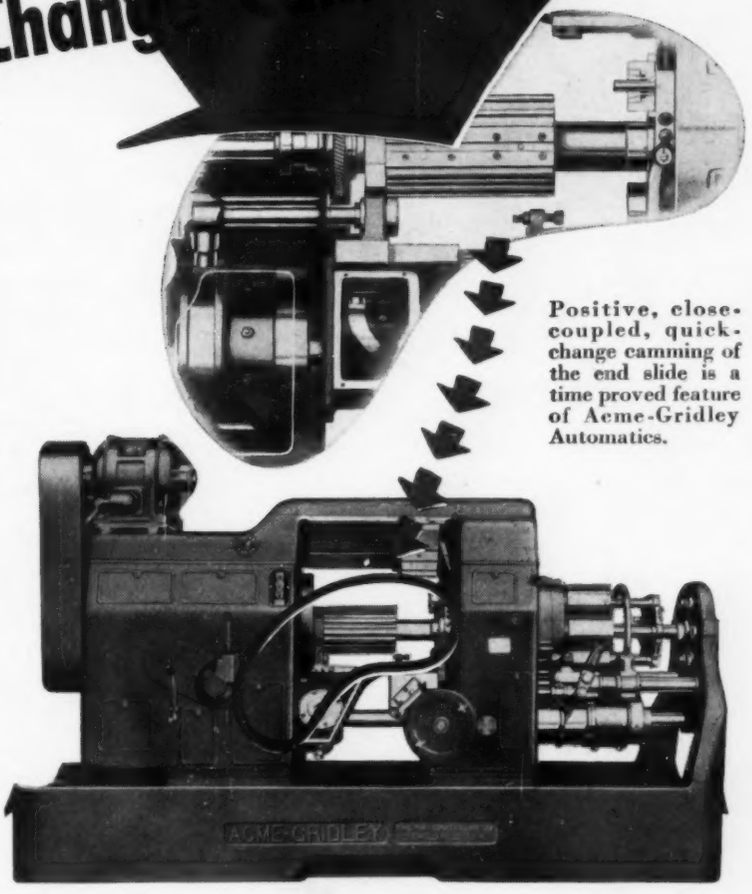
GEOMETRIC

TO[illegible]N.

YO[illegible] Lick [illegible]GH JOBS LIKE THIS



with Acme-Gridley [illegible]
Positive Quick-Chang[illegible]



Positive, close-coupled, quick-change camming of the end slide is a time proved feature of Acme-Gridley Automatics.

Here's a tough one—and the tougher they are, the more you need Acme-Gridley positive quick-change camming.

This drilled and counterbored shaft, 10″ long and 2⅜″ in diameter, is completely machined in 13 operations from SAE 1112 cold drawn bar stock, on a 2⅝″ Acme-Gridley 4 spindle bar automatic. Total machining time is 1 minute 30 seconds.

Even more important, all machined diameters are held to .003″ limits of concentricity. Where else but on an Acme-Gridley —with its heavy, rigid construction, and direct, positive camming action for all tool slides—could you hope to *maintain* such tolerances?

Positive direct camming *does* pay off. When the chips are down and the day's work has been totaled, you'll find more good pieces in the pan with Acme-Gridley automatics. They're built to take it. May we show you how they can cut production costs in your plant?

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

More Lathes mean | *Greater Choice Better Buy!*

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES
NEW YORK 6, N. Y., Singer Bldg., 149 Broadway, COrtland 7-6621
CHICAGO 6, ILL., 20 N. Wacker Drive, STAte 5561
PHILADELPHIA 40, PA., Beury Bldg., 3701 N. Broad, SAgamore 2-5900
DETROIT 2, MICHIGAN, New Center Building, TRinity 3-5561

LeBLOND

How CARD'S CERTIFICATION Double-Checks Factory Inspection

Periodically, Pittsburgh Testing Laboratory buys Card Taps on the open market. These samples are then thoroughly laboratory-tested for such requirements of cutting quality, as hardness and dimensional accuracy . . . and the results are certified.

This double-check on quality backs up every Card Tap. It's *the extra step beyond our own rigid inspection* that makes sure that these Card Tools will give you long, satisfactory service.

For prompt deliveries and helpful cooperation, contact your nearby Card Distributor.

The CARD Quality

TAPS

The Certified Cutting Tools*

*by the Pittsburgh Testing Laboratory

Also makers of DIES • SCREW PLATES
DIE STOCKS • TAP WRENCHES

S. W. CARD
MANUFACTURING CO.
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL COMPANY

On-grade

Aluminum alloys used in making Alcoa Die Castings are always "on-grade" . . . the correct percentages of alloying metals are added to the aluminum to give you die castings that suit your needs . . . high strength, light weight, sound structure, accurate dimensions that stay accurate under sustained loads.

Make use of Alcoa's 32 years of die-casting experience, 60 years in the aluminum business. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in 54 leading cities.

Alcoa Die-casting Plants at Garwood, N. J. and Chicago

ALCOA ALUMINUM

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

the Cone Reporter notes that—

Conomatic Progress Reporter

General Electric has a new thin asbestos paper for use as insulation in high temperature electric equipment.

Progress with Conomatics

Alabama Power Co. is conducting a second series of tests on the method of producing combustible gases from coal by burning it underground.

Conomatics for *Progress*

The 1″ 6-Spindle Conomatic is the first multi-spindle automatic that provides change of tool slide working travel for *all* slides without cam change.

Progress with Conomatics

A new secret alloy for gun barrels is said to greatly increase the life of all sizes from 16-inch to machine guns.

Conomatics for *Progress*

An automatic counter made by Potter Instrument Co. of Flushing, N. Y., is said to count stacked sheets of paper as fast as 1,600,000 per second. The counter can also be used on other small parts.

A process for making cheap barium chloride is reported from the University Department of Chemical Technology of Bombay, India.

Progress with Conomatics

Industrial Research Institute of the University of Chattanooga claims to have produced a transparent plastic so hard that it is practically scratchproof.

Conomatics for *Progress*

Germ-free cement is being made by North American Cement Corp.

Progress with Conomatics

Tests made by Allen B. DuMont Laboratories indicate that television is not restricted to the line-of-sight but can be received up to 125 miles.

Conomatics for *Progress*

The Army Signal Corps has developed an electric battery that will function at 100 degrees Fahrenheit.

Dayton, Ohio, is planning railplane service to its municipal airport. This system of transportation uses a suspended car and has been tried in Europe for about ten years.

Progress with Conomatics

Goodrich has a new air hose that is claimed to be as light and flexible as a lamp cord.

Conomatics for *Progress*

A new mineral (zinc tungstate) has been discovered in Argentina and named Sanmartinite after a national hero.

Progress with Conomatics

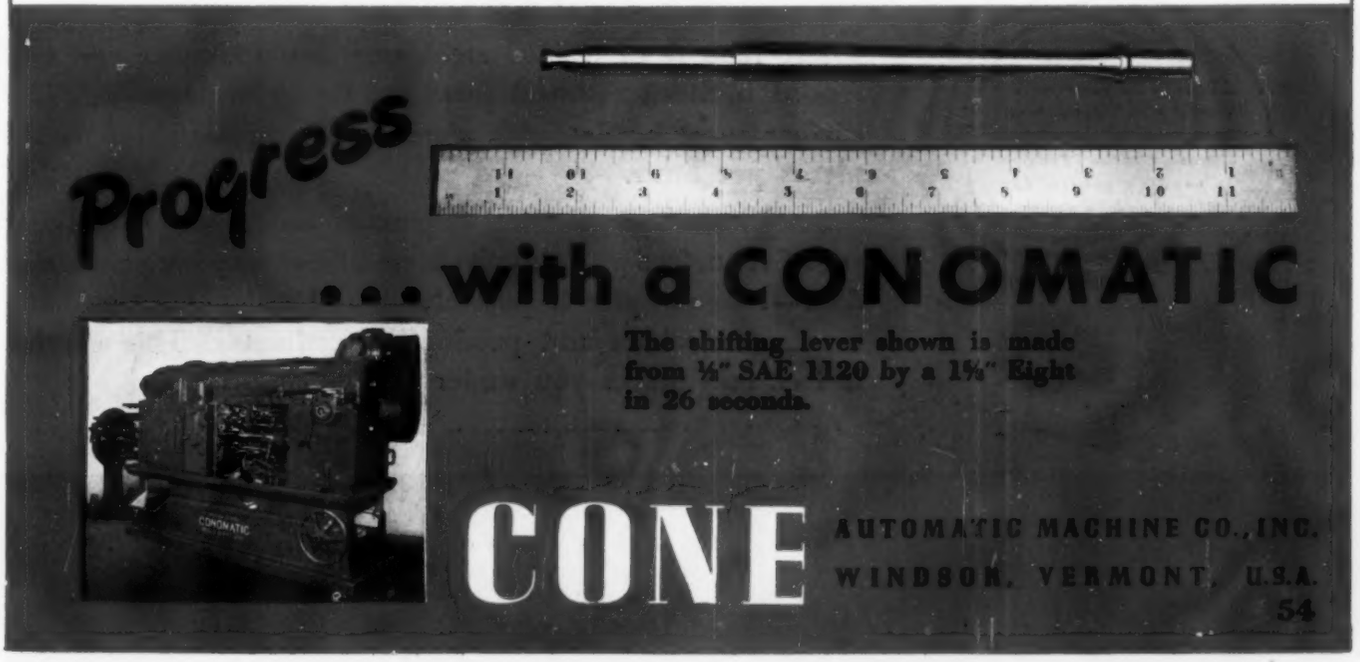
Patent No. 2,444,045 covers a method of safely removing high explosives from surplus shells in order to recover both the explosive and the steel.

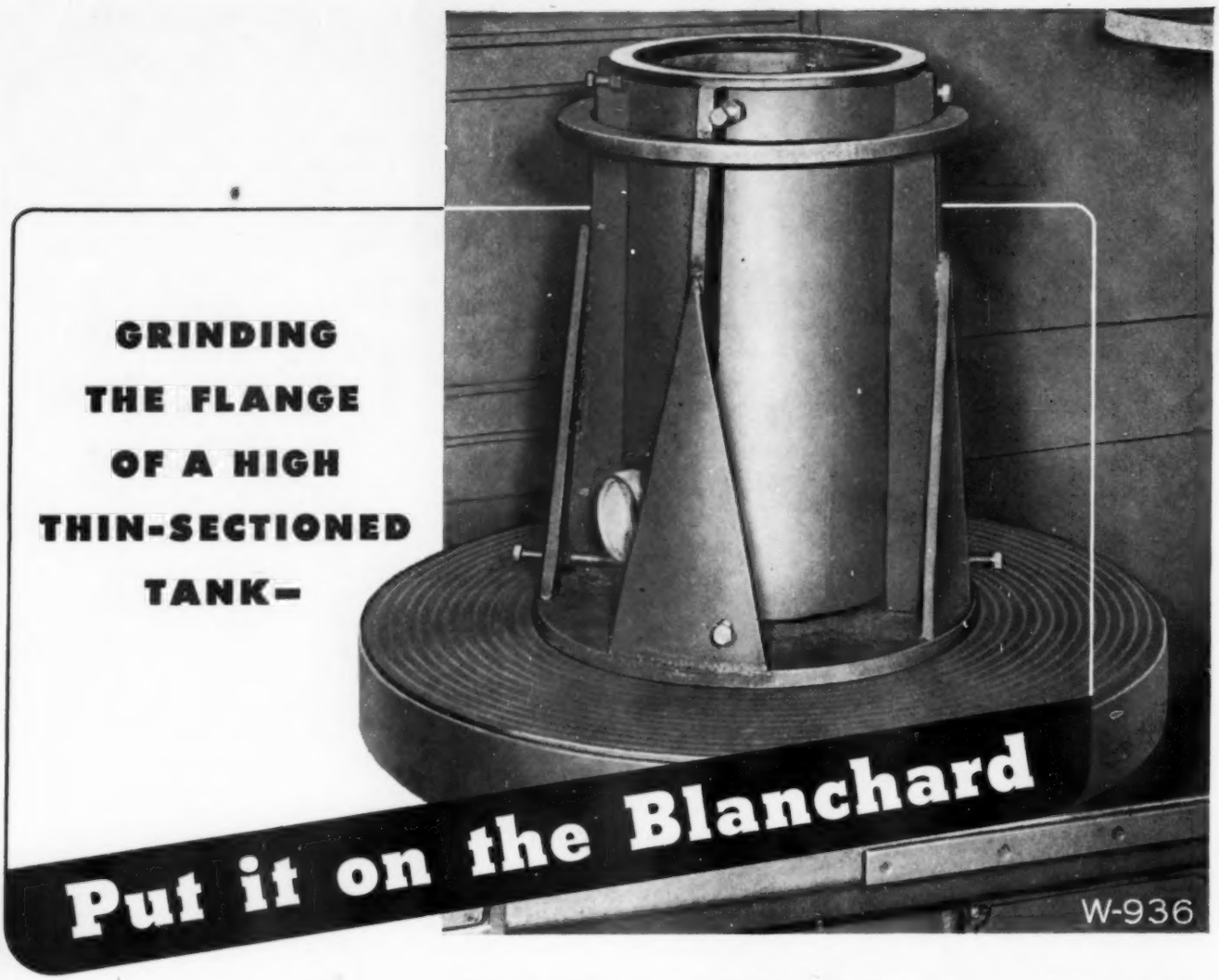
Conomatics for *Progress*

A new weaving machine is under development by Warner & Swazey. It is claimed to produce cloth about 2½ times as fast as conventional machines.

Progress with Conomatics

Owens-Corning Fiberglas Corp. makes a transparent glass cloth for use in greenhouses in place of glass panes.


Progress
...with a CONOMATIC
The shifting lever shown is made from ½" SAE 1120 by a 1⅝" Eight in 26 seconds.
CONE
AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT, U.S.A.
54



Here's another profitable "Yes" answer to the question, "Can we put it on the Blanchard"? Supported in a typically inexpensive, Blanchard-designed fixture, this Filter Tank for Gasoline Purification is held on the 36-inch chuck of a No. 18 BLANCHARD SURFACE GRINDER.

The tank is of welded steel, one foot diameter and two feet high. Stock removal from the flange averages 1/16". The surface must be flat, with a good finish. Production is six pieces per hour.

Let Blanchard grinding engineers assist you in solving *your* flat surface grinding problems. Send us your prints and data—also samples if possible. You'll quickly get reliable recommendations and production estimates. This service is free and places you under no obligation.

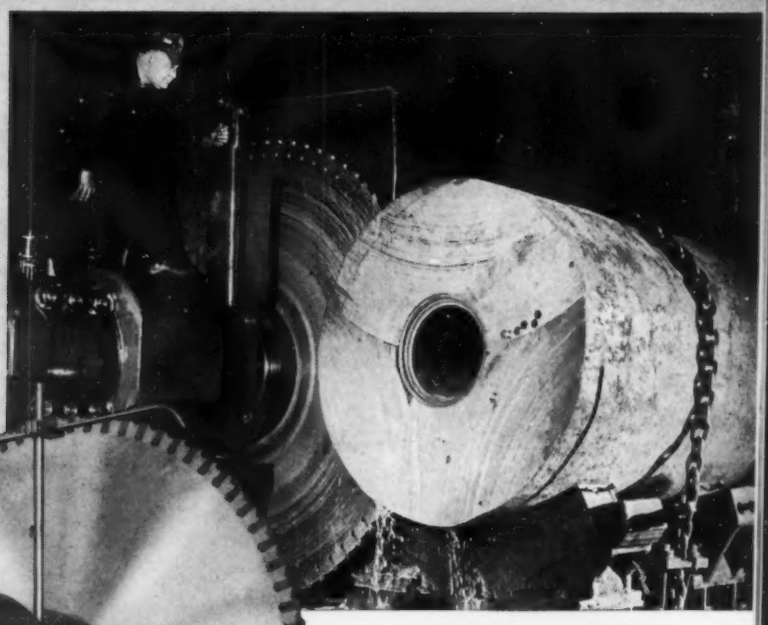
Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.
Work
THIRD EDITION

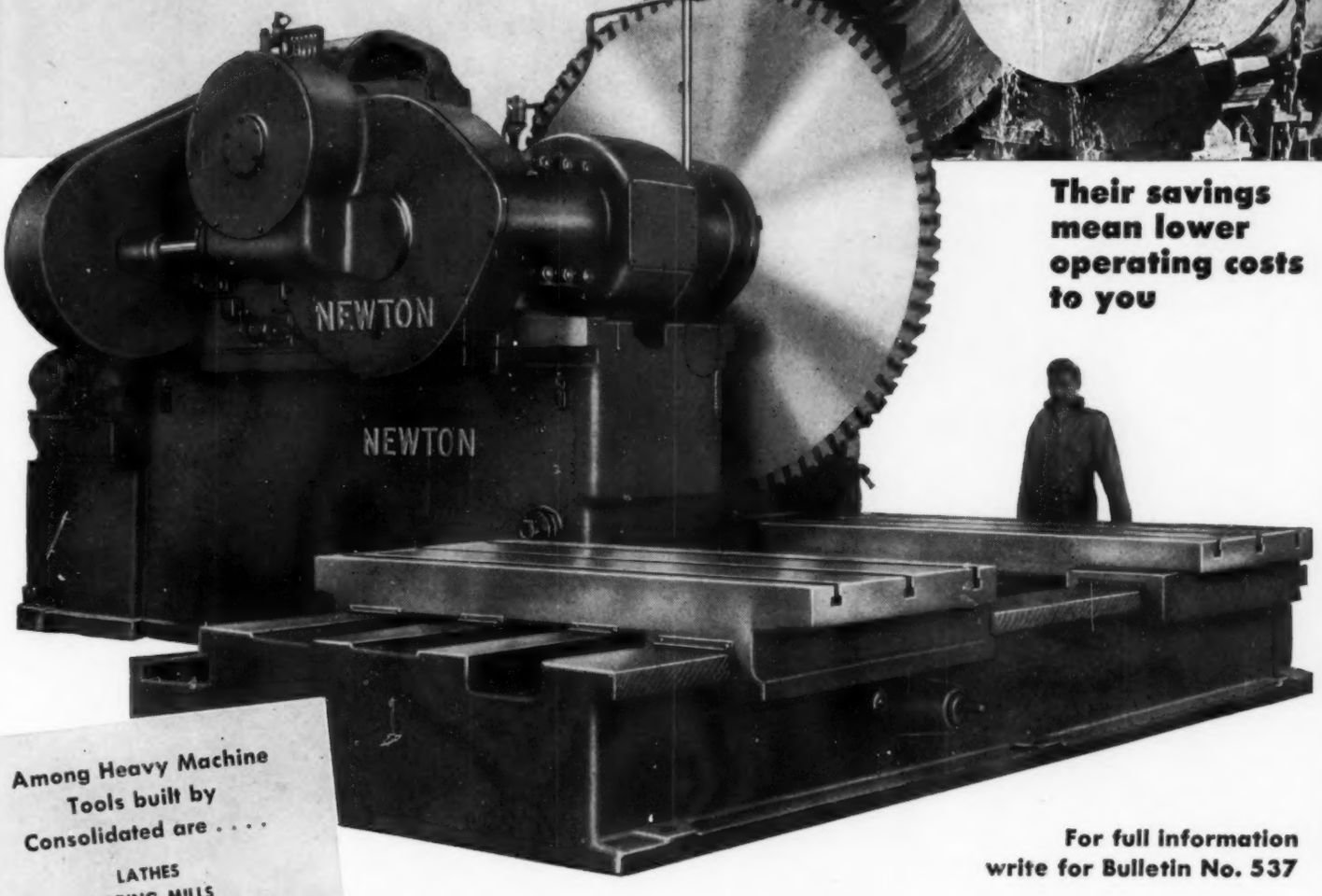
BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

NEWTON
Hydraulic Feed
COLD SAW MACHINES





Their savings mean lower operating costs to you

For full information write for Bulletin No. 537

NEWTON Hydraulic Cold Saw Machines are built in a range of designs of proved adaptability to handling all types of work in either ferrous or non-ferrous metals. Built in sizes to accommodate blades from 32″ to 120″ diameter.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

no other twist drill will outperform a UNION

contact your local distributor

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

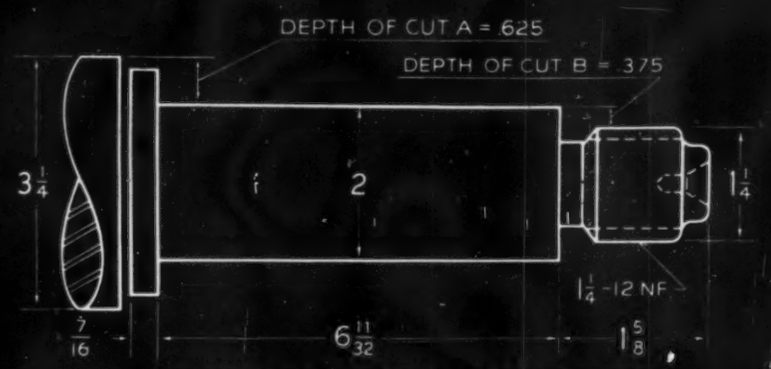
We own and operate S. W. CARD MANUFACTURING CO., Division, Mansfield, Mass.

BUTTERFIELD DIVISIONS, Derby Line, Vt., Rock Island, Quebec. Manufacturers of Taps, Dies, Screw Plates, Reamers

CAN YOU COMPETE AGAINST PRODUCTION LIKE THIS ?

ONLY 5.8 MINUTES

was required to make this Locomotive Valve Motion Pin from X-1315 Bar Stock with Carbide Tools.



LOCOMOTIVE VALVE MOTION PIN
MATERIAL X-1315

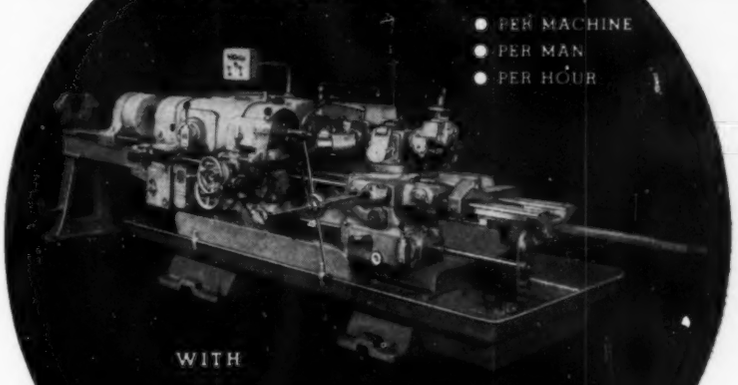
Power Turning on a Jones & Lamson No. 7A-5 Turret Lathe. Cut "A" required 22 HP for each piece at 220 FPM / .022 feed . . . Cut "B" took 17 HP at 275 FPM / .022 feed. Production was doubled.

This is a typical example of what can be accomplished with a lathe designed, built and powered to obtain maximum production.

Write for Folder No. 486 describing this operation in detail, or better yet, ask for one of our engineers to study your lathe operations. His recommendations will reduce your costs.

Increase your Production—

- PER MACHINE
- PER MAN
- PER HOUR



WITH

Jones & Lamson
UNIVERSAL
TURRET LATHES

DESIGNED to lower every turning cost.

BUILT for maximum production with either carbide or high speed steel tools.

POWERED to produce more chips per tool, more pieces per hour, more profit per job . . . than any turret lathe of comparable range.

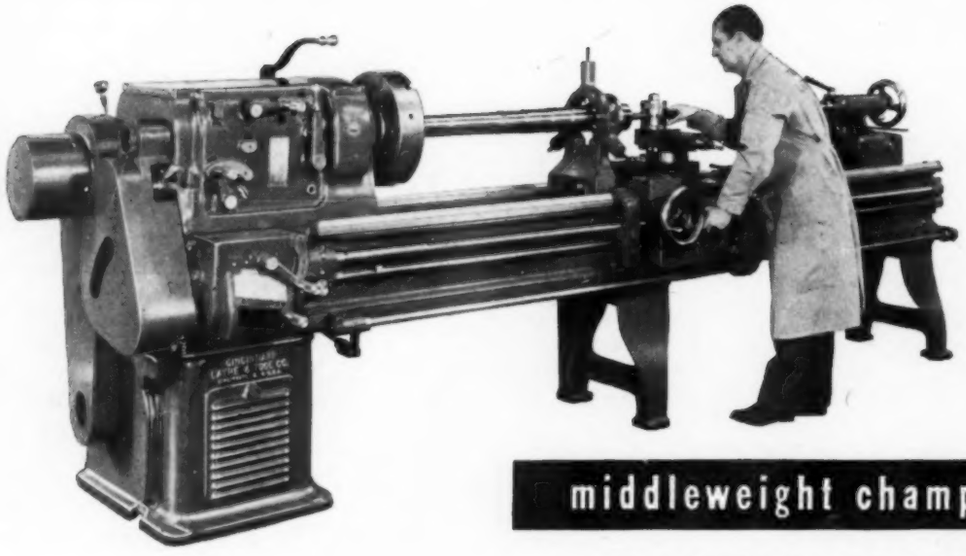
Turret Lathe Division

J&L JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

The new Traytop line of light duty geared head engine lathes (10", 12½", 15", and 18" swing sizes) offers many "high price" lathe features at truly low cost: 12 spindle speeds, selected by color-coded dial; 48 thread and feed changes; exceptionally large spindles, anti-friction bearings, double-walled apron; totally enclosed gear box; many others. Distance between centers from 18" to 60". 15" and 18" sizes can be furnished with gap and gap block. Write for Bulletin T-100.

lightweight champ



middleweight champ

In the medium duty class, the Standard line (14", 16", 18", 20", 22", and 24" nominal swings) assures you real all-around utility with exceptionally low initial investment; quickly pays for itself by efficient handling of practically all your turning, boring, and threading operations. 12 spindle speeds; 32 thread and feed changes; distance between centers from 32" to 238". All sizes available with gap and gap block. Write for Bulletin S-100.

cintilathe

OF OUTSTANDING VALUE

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO

hob costs reduced 4 times

with BARBER-COLMAN CARBIDE-TIPPED HOBS

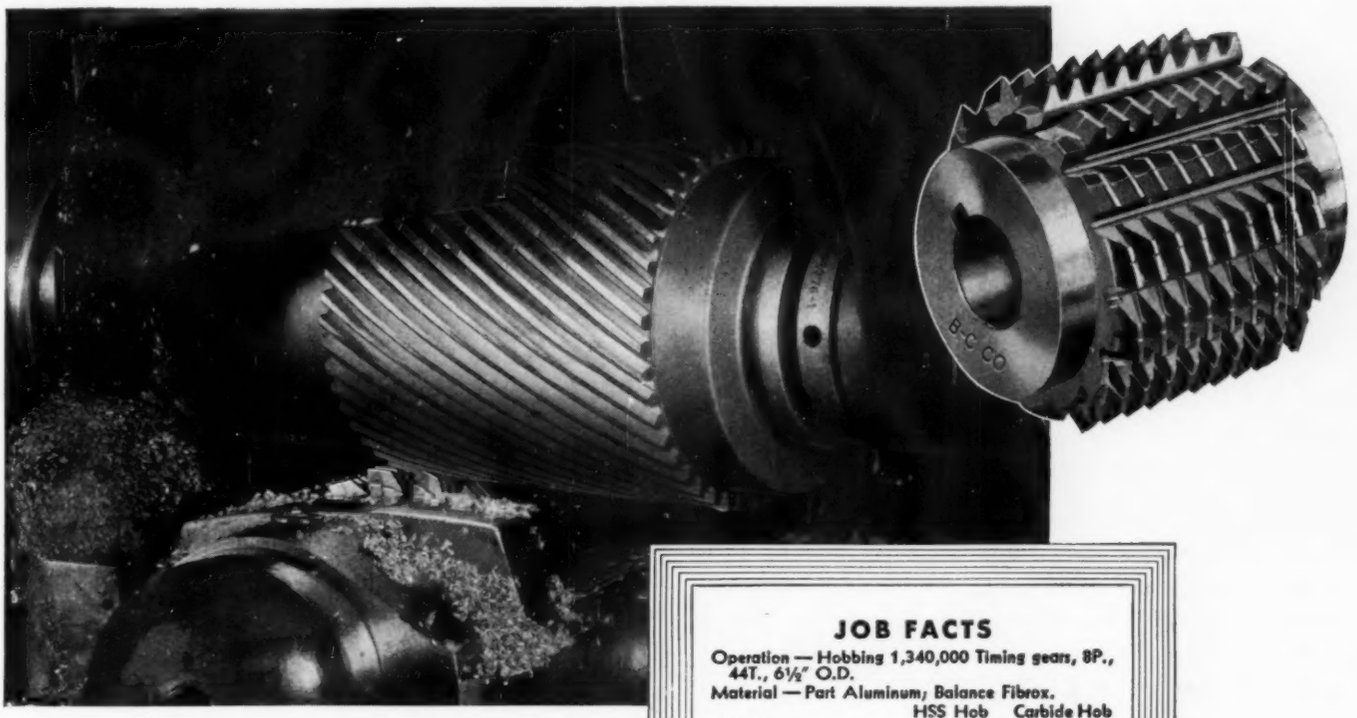
Unfortunately, tool cost in gear hobbing does not stop with the original hob investment. For after the hob is mounted on the machine, it costs something more to use it. Direct labor cost is closely tied-in with feeds and speeds used, resharpening required, and quality of the work produced.

Barber-Colman Carbide-Tipped Hobs have been developed to solve the problem of rapid hob wear in abrasive non-metallic materials. A double saving results from fewer sharpenings and production of more pieces in less time.

Ask Barber-Colman Engineers to submit estimates on either Carbide-Tipped or High-Speed Steel Hobs to meet your production requirements.

Barber-Colman Company

GENERAL OFFICES AND PLANT 116 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.



JOB FACTS

Operation — Hobbing 1,340,000 Timing gears, 8P., 44T., 6½" O.D.
Material — Part Aluminum; Balance Fibrox.

	HSS Hob	Carbide Hob
Hob Size	3" x 3-1/4"	6" x 5"
Feed	.66"/min.	6"/min.
Speed	240 RPM	800 RPM
Fl.-to-Fl.	1-2/3 min.	1/3 min.
Hob Cost	$1625.00	$1007.00
Sharp. Cost	3780.00	310.00
Total Tool Cost	$5405.00	$1317.00
Cost Per Gear	$ .00404	$ .00098
Pieces Per Sharp.	1600	67,000

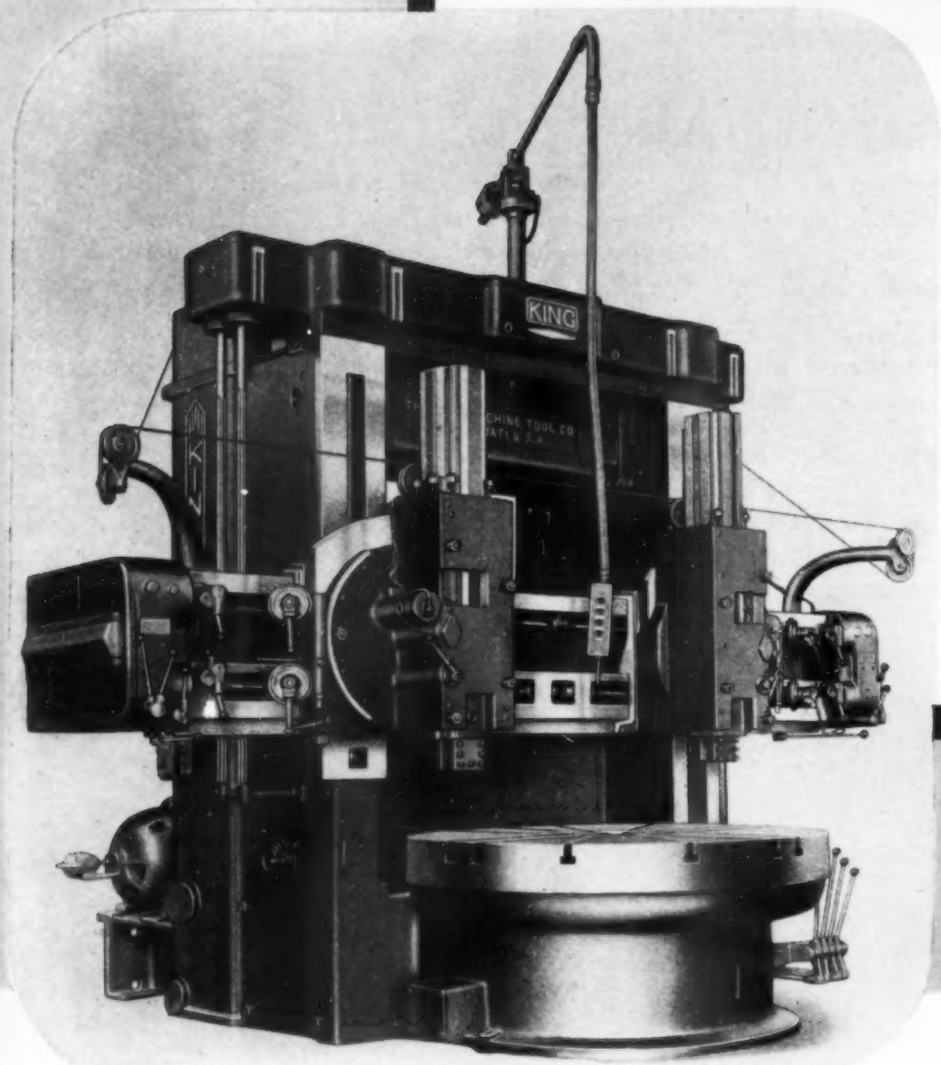
Hob Life — 1 Carbide Hob Equivalent to 28 HSS Hobs.

MODERN MACHINES DEMAND *Modern* CUTTING TOOLS

BARBER COLMAN

THERE'S A REASON WHY

The New Series KING



- **meets close tolerances**
- **maintains accuracy**
- **reduces costs**

● The New Series KING Vertical Boring and Turning Machine is *easy to operate.*

For example, angular hand adjustment levers with micrometer dials for vertical and horizontal movement of the head are an integral part of the head and move with it. They enable the operator to make precision adjustments easily and quickly from his normal working position, saving time and labor.

The massive rectangular type ram heads . . . the ram heads square locked and fitted with four tapered gibs for accurate adjustment . . . the heavy tie plate across the swivel . . . all assure high and consistent accuracy.

These and other important features, including full range of feeds and speeds, make possible maximum production at exceptionally low costs.

Consult a King Engineer on your precision turning, boring, facing, and similar operations.

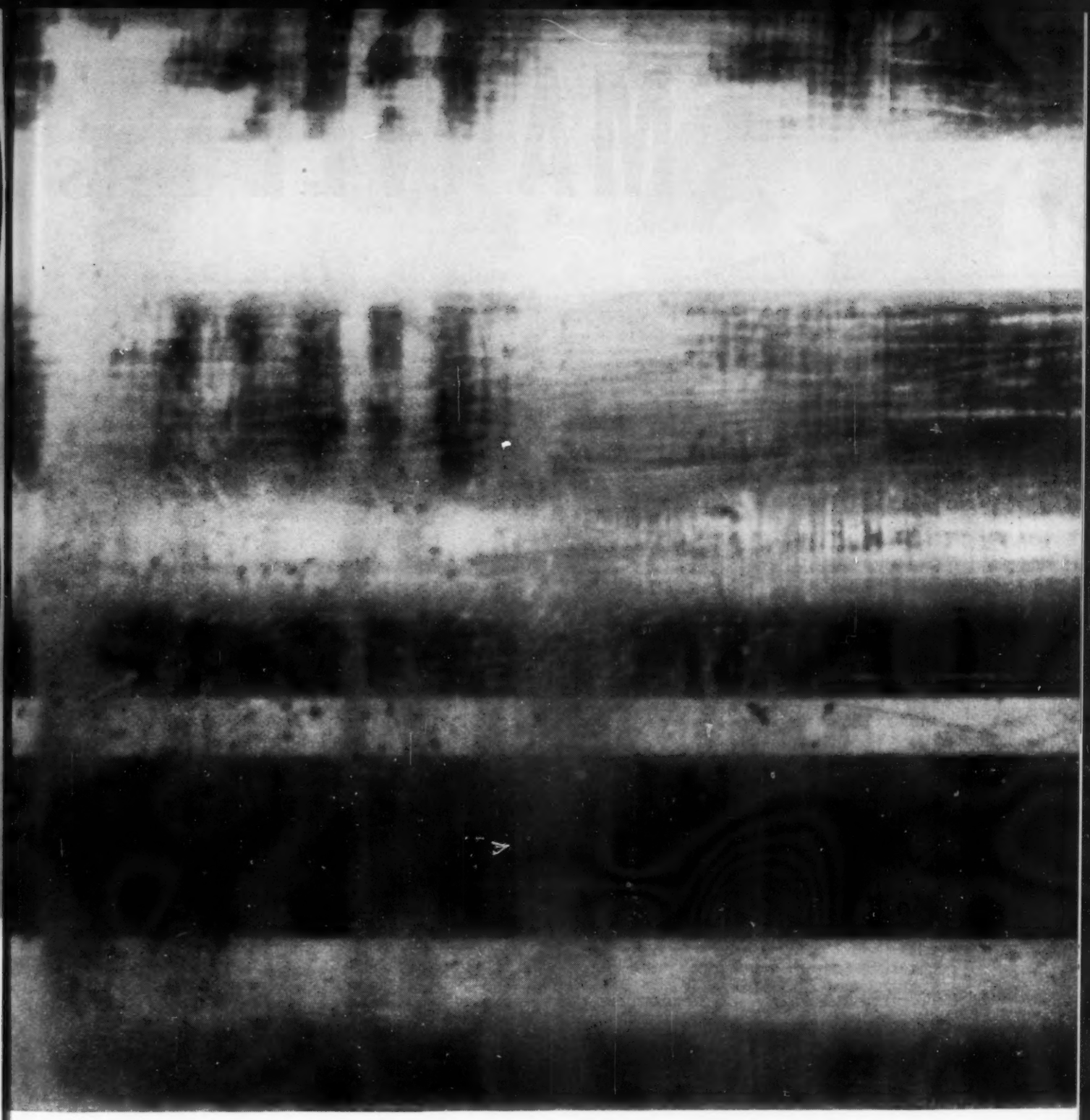
Ten sizes available, from 30" to 144".

American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of Vertical Boring & Turning Machines and Sebastian Lathes

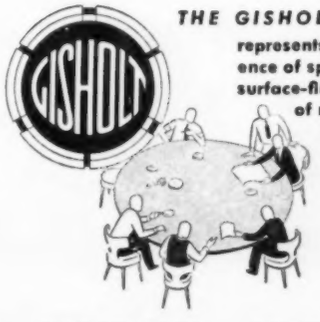


Close-up of *DANGER!*

The main bearing of this small crankshaft was originally finished by a mechanical sanding machine. Then it was partially Superfinished—just enough to reveal the lack of adequate bearing capacity. Light abraded areas are the only true geometrical surface. Dark areas are low spots which carry no bearing load. The area contact of the Superfinishing stone brings out deficiencies in production which were never intended by the designing engineer.

For more information on Superfinishing, write on your company letterhead for the new textbook, "Wear and Surface Finish."

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin



THE GISHOLT ROUND TABLE
represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

"MARVEL *HAS the edge*

MARVEL High-Speed-Edge Blades assure Faster, more Accurate cutting with proven Economy and complete Safety. Only the MARVEL is a composite blade with a genuine 18% Tungsten high-speed steel cutting edge electrically welded to an exceptionally tough, strong alloy steel body.

The High-Speed-Edge does the cutting while the alloy back with hardened eyes, carries the load. Blade tensions up to 300% higher than those possible with ordinary blades are recommended. This greater tension is confined to the cutting or leading edge by the location of pin holes (exclusive MARVEL design feature) and cannot be overcome by work resistance. Heavier feeds and greater speeds are practical without "run out."

With greater accuracy, higher production, and lower cost per cut, come the extra dividend of Safety, for MARVEL High-Speed-Edge Hack Saw Blades are Positively Unbreakable—they will not shatter.

Ask your local MARVEL distributor (see classified phone book) to help you modernize your metal sawing with MARVEL High-Speed-Edge Blades. They cost no more than ordinary high-speed steel blades.

1. **Genuine 18% Tungsten High-Speed Steel cutting edge.**

2. **Tough unbreakable alloy steel body with hardened eyes.**

1. & 2. **Integrally welded to make a fast-cutting, long lasting composite blade that is positively unbreakable.**

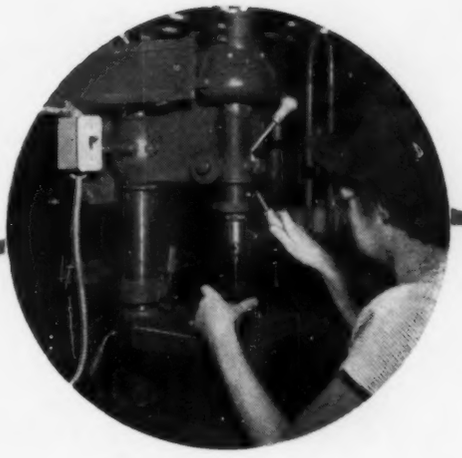
ARMSTRONG-BLUM MFG. COMPANY

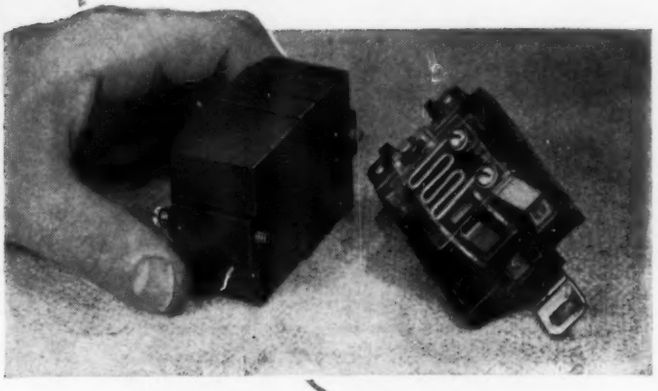
"THE HACK SAW PEOPLE"

5700 BLOOMINGDALE AVENUE **CHICAGO 39, U. S. A.**

Metal Cutting MARVEL SAWS

Better Machines—Better Blades





F-HP* MOTOR-STARTING SWITCH . . .

New Design for improved performance

Entire new line of CR1061 manually operated switches—general purpose, water-tight, explosion-proof types—now available. New from cover to heater. Check these features for:

EASIER INSTALLATION

- All wiring terminals easily accessible on top of switch unit
- Heaters have one mounting screw fastened in position to prevent incorrect mounting—stamped with current rating

POSITIVE OVERLOAD PROTECTION

- Employs sturdy bi-metallic protective device
- Positive indication power is off as switch handle moves to OFF position on overload

LONGER LIFE

- Self servicing—wheel-type movable contact cleans as it rolls against stationary contacts
- High interrupting capacity—arc snuffed quickly as silver contact recedes into recess in base

**Fractional Horsepower*

USE . . .

On a-c up to 1 hp at 110 to 220 volts
On d-c—¾ hp 115 volt, ⅓ hp, 230 volt
double-pole forms for 1 hp, 115 to 230 volts d-c
Fill in the coupon and send it in for more information. *Control Division, Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Apparatus Dept., Sec. D676-276
General Electric Company
Schenectady 5, N. Y.

Gentlemen:
I want to know more about your new CR1061 switches.
Please send me Bulletin GEA-2234E.

NAME.....
COMPANY.....
ADDRESS.....
.....

GENERAL ELECTRIC

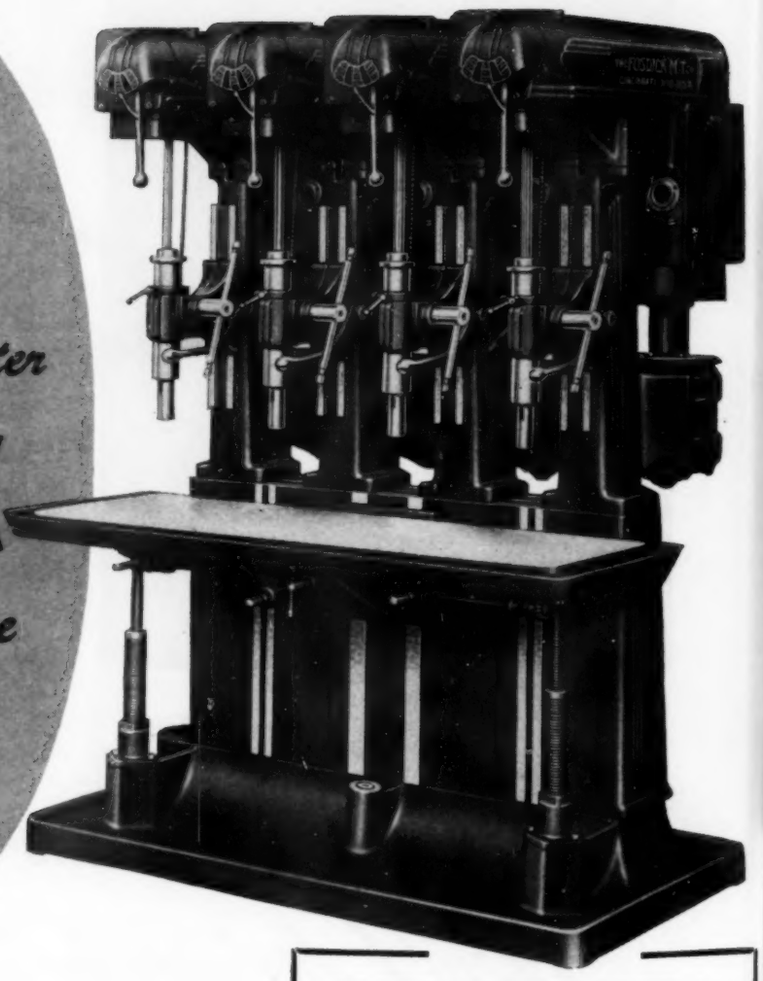
FOR DRILLING...
REAMING...
TAPPING

holes up to 1 1/2" diameter

FOSDICK

High Speed Sensitive

DRILLS



● This Fosdick High Speed Sensitive has proved most popular for drilling, reaming, boring and tapping holes up to 1½" diameter.

Single speed motors with complete controls are furnished with the machine. It is available in any number of spindles up to six. Spindles are designed to carry multiple drill heads. Addition of an extra contactor provides spindle reverse for tapping. The drive to spindle is through Vee belts. All revolving shafts are mounted on anti-friction bearings and gears slide on splined shafts. Machines are furnished with box or round columns depending upon your requirements.

This line of Fosdick drills offers exceptional economy for drilling—reaming—facing—and tapping operations on work within its capacity.

Write for complete details—fully covered in Fosdick H. S. Bulletin H. S. A.

FOSDICK ALSO BUILDS

. . . a distinctly new Radial Sensitive Drill

•

Hydraulic Radial Drills

•

Heavy Duty Upright Drills and Jig Borers

•

Bulletins available—write

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

Follow the ~~blue~~ pink print for lower metal cutting costs

You'll see an important scaling down of metal cutting costs when you switch to Cimcool. It's a revolutionary new cutting fluid—a *chemical emulsion*—that cuts costs in three major ways:

1. Cimcool prolongs tool life (and that means less down time) because of its *chemical lubricity.*
2. Faster speeds are possible because Cimcool cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.
3. Cimcool costs less than old-fashioned cutting fluids because it lasts longer. It isn't subject to rancidity. Its low surface tension and low adhesion to work and chips virtually eliminates carry off.

CIMCOOL DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

CIMCOOL *for* 85%

OF ALL METAL CUTTING JOBS

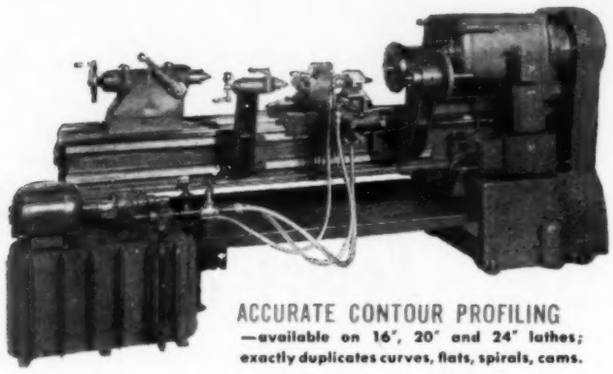
Trade Mark Reg. U. S. Pat. Off.

SPRINGFIELD

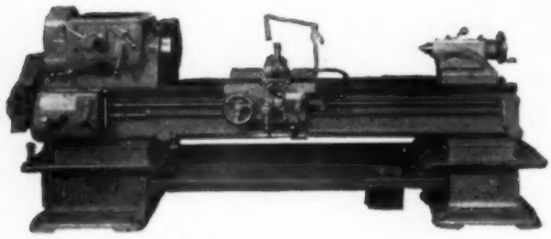
Geared Head LATHES

Springfield builds a complete line of precision, high quality, geared head lathes. Every type of lathe built by Springfield is especially designed and constructed to meet all the requirements of modern tooling, and to retain extreme accuracy through many years of full capacity production.

Write for catalogs and detailed specifications.

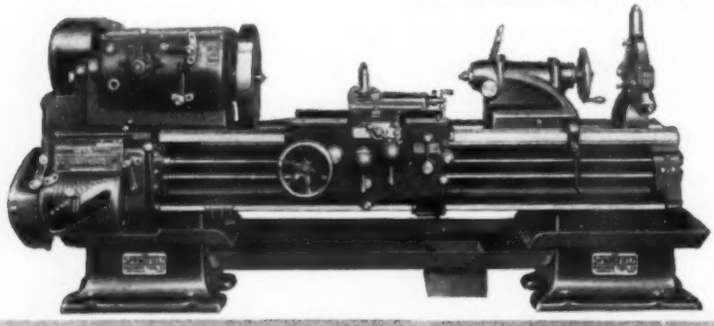


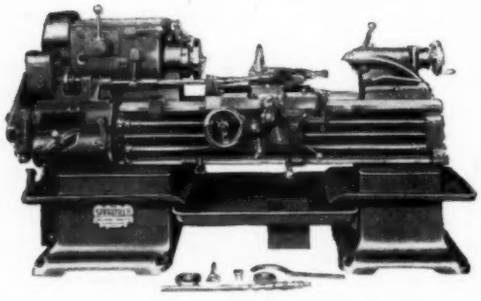
ACCURATE CONTOUR PROFILING
—available on 16", 20" and 24" lathes; exactly duplicates curves, flats, spirals, cams.



MANUFACTURING LATHE
—with unusually wide applications; capable of accurately turning, boring and facing.

SUPER DUTY LATHES
—made in 20" and 22" sizes; equipped with 16-speed geared heads.





TOOL ROOM LATHES
—made in all sizes including 24"; equipped with lead screw reversing mechanisms.

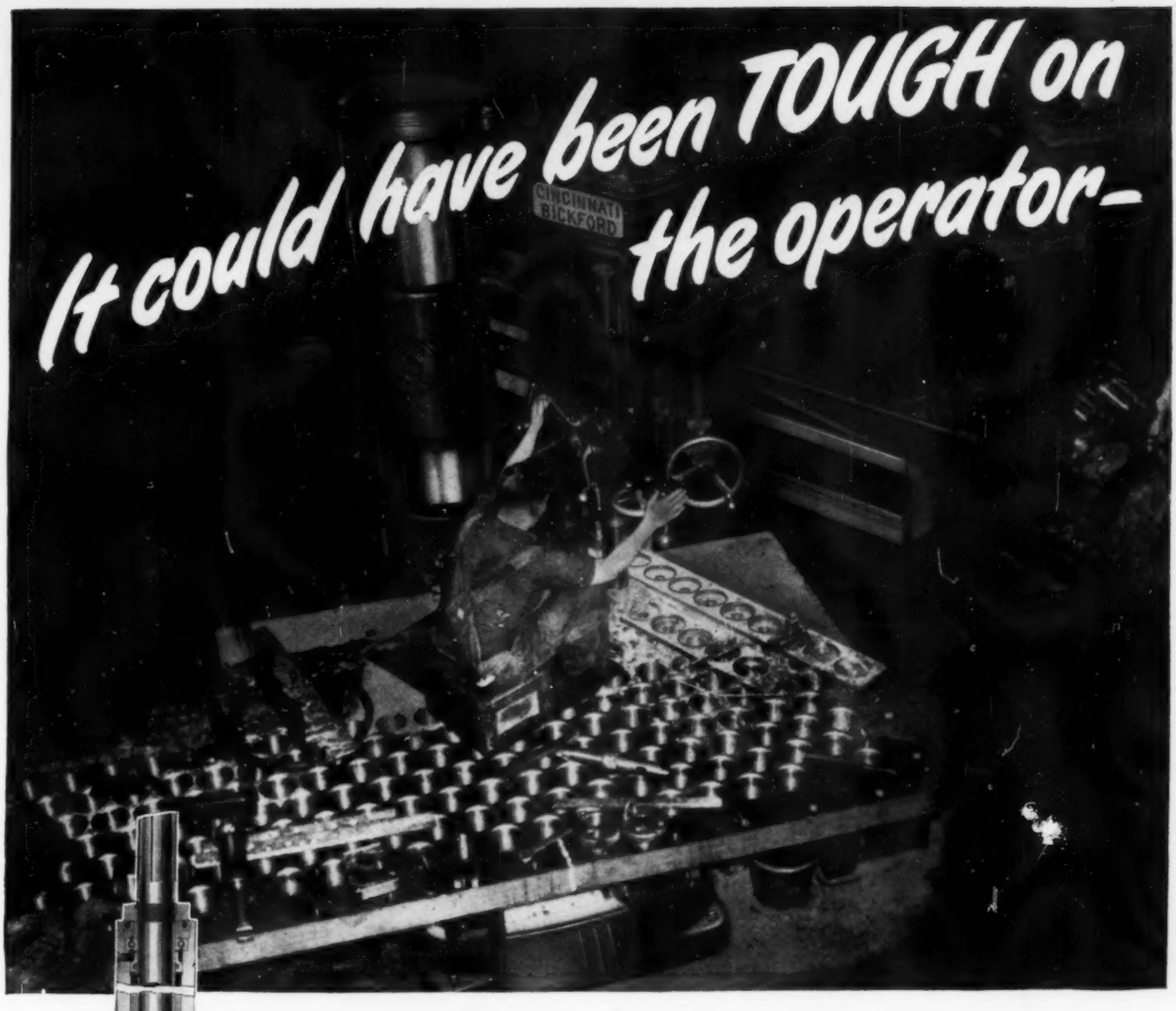
THE SPRINGFIELD MACHINE TOOL COMPANY

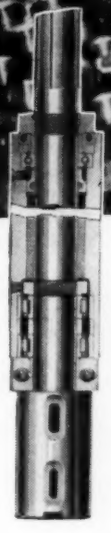
SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

It could have been TOUGH on the operator—





Contributing to the unusually long trouble-free performance of Super Service Radial Drills is the spindle and sleeve construction. Note that the sleeve and its spindle supporting bearings feed down with the spindle so that no matter what length of feed is required or how far the spindle is extended from the head, it never feeds away from its supporting bearings, but is always rigidly supported by these bearings just above the spindle nose.

Power, stamina, accuracy and concentrated operator control were all required on this job.

One drilling and two fly cutting operations were performed. Size of holes: 5", material 6½" armor plate. From a minimum of fifty holes to several hundred were produced per piece.

The Cincinnati Bickford Super Service Radial Drills give a sustained accurate and speedy performance—with maximum ease to the operator.

Write for Bulletin R-29 for details on this modern powerful radial drill.

THE CINCINNATI BICKFORD TOOL CO.
RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Radials 7½" dia. col., 2½' arm, to 96" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
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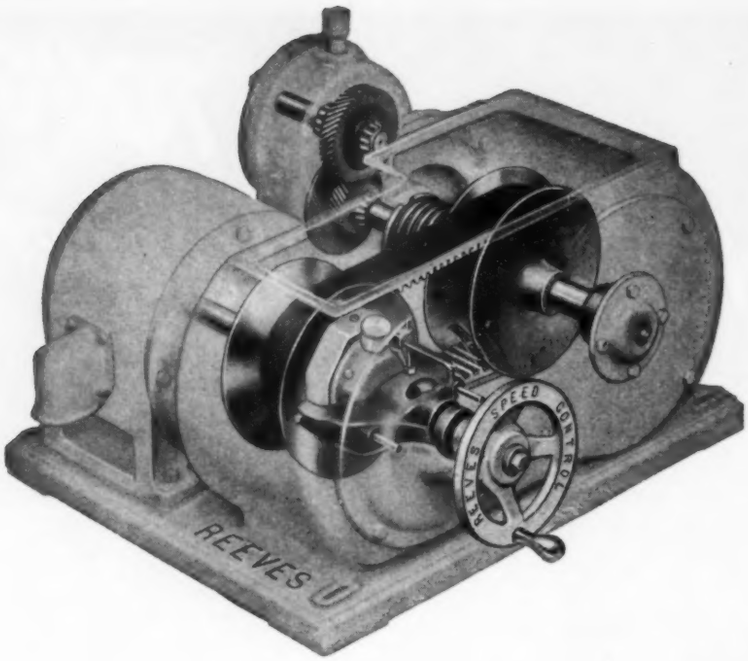

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These testimonials aren't letters—but machines! They are doing the intricate jobs, the strange jobs and the familiar jobs on production lines in scores of industries, your own included. They are handling materials of widely varying consistency, weight, hardness and temperature . . . steel, textiles, rubber, foods, plastics, glass, pharmaceuticals and many others. They are stamping, grinding, shaping, turning, winding, spreading, cooling, buffing, conveying and so on . . . some under the direction of skilled, experienced operators and others in the hands of awkward newcomers. But this they have in common: *all* 260,000 of these machines are equipped with REEVES Speed Control . . . *all* are performing each and every operation at exactly the right speed to get the best from man, material and machine . . . *all* are proving, through their day-after-day performance, that REEVES holds the key to improved production—cost-wise and quality-wise! Write for copy of 114-page catalog A9-450A.

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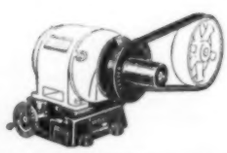
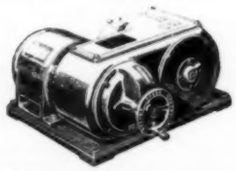
THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

SPOT NEWS OF METALWORKING

Detailed regulations on occupational deferments are due soon. No specific industry will get a blanket deferment, but men who fall into specified occupations will be deferred.

U. S. exports to Russia dropped to less than $50,000 in June, compared to an average of $6.9 million monthly for the first quarter of 1948. Much of the cut was in industrial equipment and machinery.

India is soon to receive 4,000 machine tools from Germany under war reparations, and a problem of distribution has arisen. This job is made more difficult by 1,500 machine tools listed as war-surplus.

British industrial production has been running 20 to 25% above the 1946 level. Official sources attribute this gain to ECA help on tools and raw materials.

Scrap iron is now enroute from Germany. Commerce Department has closed a deal for 440,000 long tons of rubble scrap; 200,000 tons has been loaded at Bremerhaven for shipment to the U.S.

Current merchant and naval shipbuilding orders, coupled with future plans, run close to $1.5 billion. Naval orders in industrial yards are proving a boon to shipbuilding.

Pool orders for machine tools will be placed with the industry shortly by the National Security Resources Board and the Munitions Board. In the event of an emergency, a telegram from the RFC will start work on specific lists of products. (Story on Page 129.)

A voluntary steel allocation program for mining-machinery manufacturers is now under study. The industry is estimated to need about 47,800 tons of steel a month. The Bureau of Mines insists everything possible must be done to maintain and increase output of coal and metals.

Metal-stretching machines of five to ten times the capacity of the present Hufford machines at North American appear a strong possibility. The Air Force has requested a survey of metal-working shops and, if favorable, North American will work with Hufford on new designs.

Boeing Airplane Co.'s backlogs have risen over $77 million as a result of the Aero Mechanics Union strike. On top of this backlag there is a new order for 162 additional B-50s for the Air Forces.

Washington expects General Motors workers to get another cost-of-living wage increase of a few cents when the second quarterly adjustment occurs Dec. 1. They received 3 cents on Sept. 1.

Employment in manufacturing industries continued its slight downward trend in July, reaching 16,181,000, according to the Bureau of Labor Statistics. With more materials available, the automotive industry added about 60,000 workers, reversing the downward trend of the last four months.

Gaging Metalworking

Despite a dip in industrial production in the spring, which was reflected in the AMERICAN MACHINIST Index, the total of goods and services produced in the country increased. The gain in May and June was enough so that the Commerce Department announced gross national product was at a rate of $248 billion a year in the second quarter.

A major part of the gain, however, reflected inflation. This was particularly true in consumer goods and services, where prices increased faster than the actual total produced.

With the total dollar value of goods and services gaining at that rate, it will be only a month or two before gross national product reaches an annual rate of $250 billion.

Motor Vehicles up 10%

Factory sales of motor vehicles during July totaled 474,387 units, an increase of approximately 10% over June. This was the second highest production rate since the war. In March 492,013 vehicles were built. July's output of passenger vehicles was the highest of the year—356,582 were built.

Supplier strikes, shortages of material and heat were expected to cut production figures down slightly for last month.

Gear Output Rises

The new Index figure for July of the American Gear Manufacturers Association (1935-39=100) shows an increase in volume of 7.5% over that of June. The new July figure is computed to be 348.4.

Industrial Buying to Continue

Fears that capital expenditures for manufacturing plant and equipment will taper off to a point where a general recession will set in are held unwarranted as the result of a recent survey.

The current rate of expenditures in 1948 was found to be in line with the prewar pattern of 1931-1940, and, although above any peacetime year, not excessively high.

Machine tools were found to be running about the same in volume as in 1939, which is contrary to the over-all plant and equipment pattern. Competition from government surplus was blamed for this condition in a report of Management Planning of Washington, Inc., New York, which predicted a steady climb upward of machine tools in the ratio to plant and equipment expenditures from the 1947 level of more than 3% to the 5% to 7% relationship which prevailed before the war.

Labor Shortages Seen

Air Force expansion and ECA appropriations are expected to produce local labor shortages, particularly in aircraft and shipbuilding centers, according to the Labor Department. Some are already being felt.

A major source for the aircraft expansion program will probably be from those already employed in other industries, due to the fact that there is so little labor surplus and many of those unemployed are not occupationally suitable. The department reported adjustment of labor supplies through migration would be difficult in the face of the housing shortage.

Tool, Die Backlogs Slashed

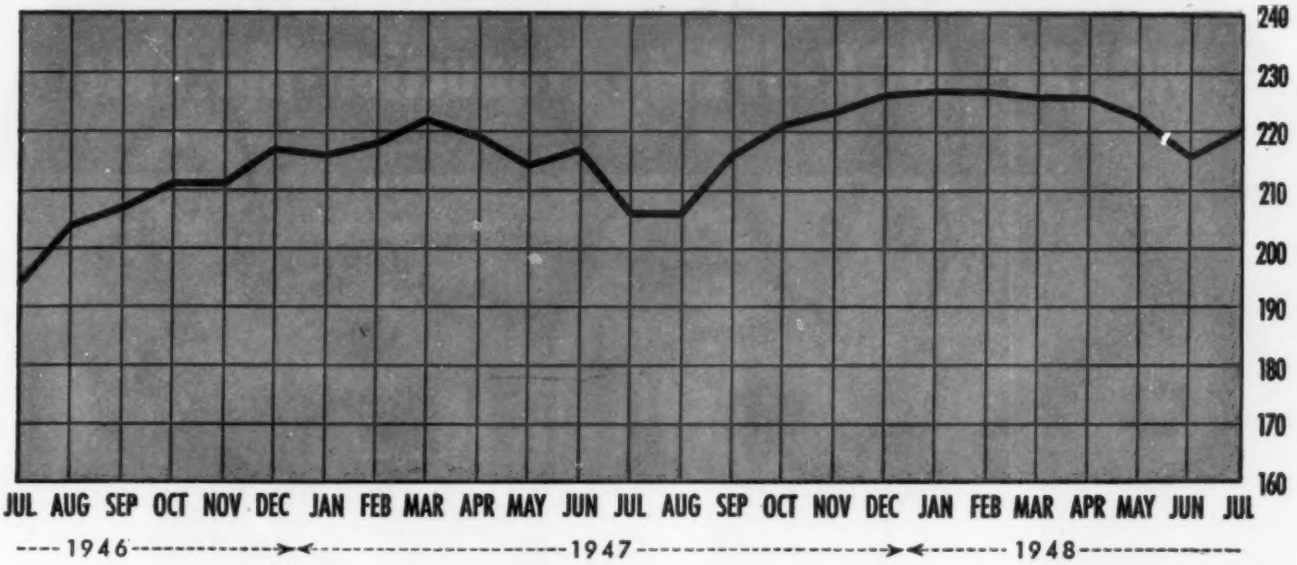
Backlogs in tool and die shops are shrinking rapidly and many of the smaller shops are reported cutting prices in order to keep operating. Little or no profit is made by the small war-born shops and profits for the large, well-established shops are decreased.

The only bright spots continue to center in Cleveland, Dayton and Milwaukee. New England reports a slight improvement but not enough to produce any kind of a backlog.

Strikes in the Detroit area have

ECA Funds for Industrial Products in Million $

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX		COMPONENTS				
		MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
JULY 1948.....	220	250	226	229	305	147
JUNE 1948.....	216	250	227	217	282	148
JULY 1947.....	206	230	226	212	261	141

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1 Index figures are a percentage of 1939, which equals 100.

slashed delivery dates on jigs and fixtures to less than four weeks; sheet metal tools to four weeks, and forging dies to five weeks. Two to three weeks are thereby cut from what was considered an average delivery date in each of the three categories.

Gas Ranges Set Record

Residential gas range sales reached an all-time high of 1,444,000 units during the first six months of 1948, exceeding by 283,000 the sales during the first six months of 1947, the previous peak year. Total annual production is expected to exceed that of 1947 by 500,000 and reach 2,800,000 units.

However, factory sales of standard-size household vacuum cleaners dropped from 256,071 in June to 229,537 units in July, a decrease of 10.3%. Sales for the first seven months of this year are 2,039,989 units compared to 2,111,169 in the same period of 1947.

Chicago Building High

Postwar factory construction in the Chicago industrial area now totals more than $0.5 billion. This includes construction projects in 702 industrial plants in the five Illinois counties and one Indiana county of the metropolitan district. This represents the largest development of any of the industrial areas in the United States since the war.

During the war years, new plant construction totaled $1,166,970,000. In the 12 months ended July 31, industrial developments totaled $138,527,000.

Furnace Scrap Plentiful

Supply of blast furnace scrap in the Cleveland area is good. One concern reports it can obtain more than enough to meet requirements at the formula price. Open hearth scrap, however, is scarce and in heavy demand. Some buying over the formula price has been reported in the Buffalo area, and it is believed that much can be obtained over the market price.

Non-Ferrous Metals Strong

Buying interest in major non-ferrous metals for September shipment continued strong through last month and the price situation in copper, lead and zinc continued firm. Work stoppages at lead and zinc mines reduced the supply. The price of silver was unsettled, dropping to 72¾ cents an ounce troy. Tungsten ore sellers were encouraged by reports that stockpile buying of this mineral may come into the market on a large scale.

The demand for aluminum continued to increase, but new customers were unable to buy the light metal. Rationing by producers to old customers continues and the power shortage continues to hold major producers from reaching plant capacity.

Foundry Production Up

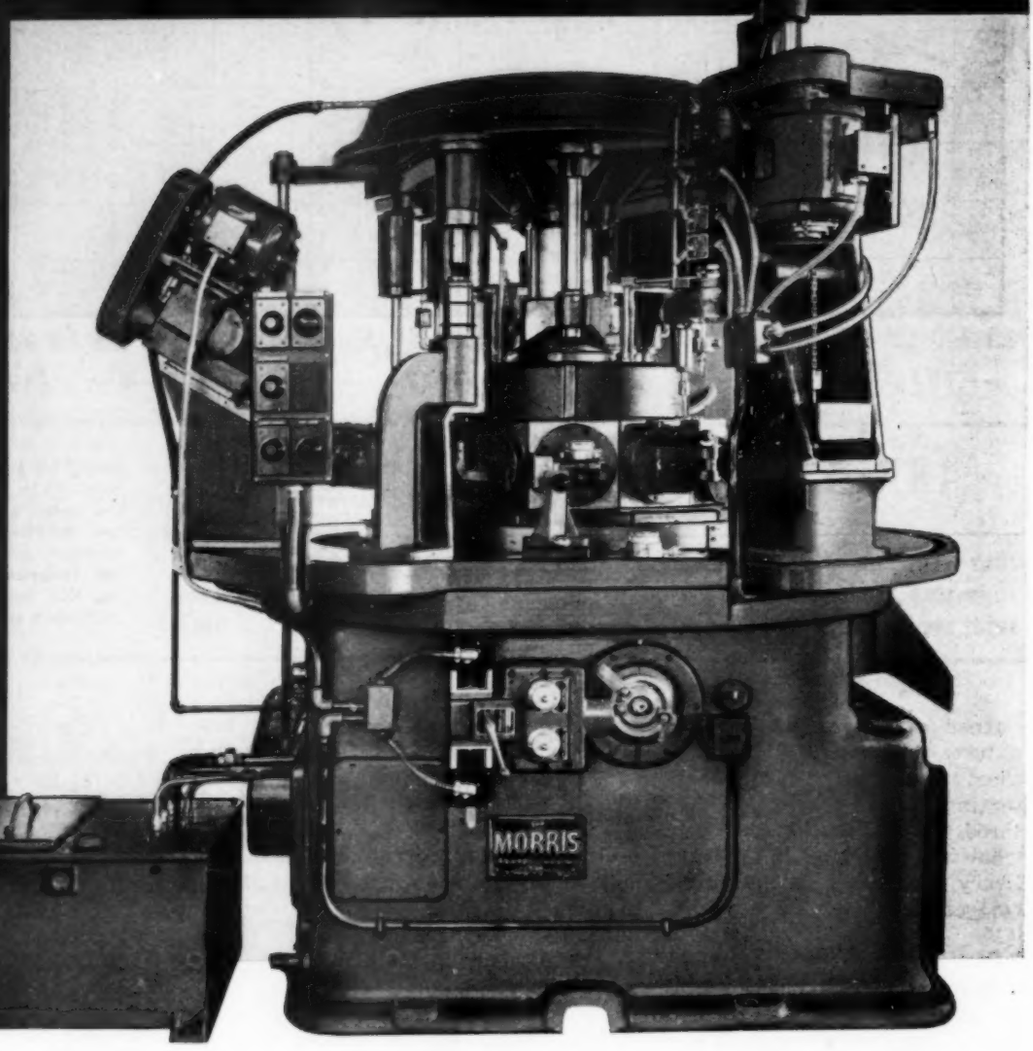
Production of iron and steel foundries for the first four months of 1948 was above that of the same period last year. The Bureau of the Census estimates gray-iron castings up 1%, malleable-iron castings up 4%, and steel castings up 10%. Despite this, some plants are operating below normal because of a lack of current orders or the termination of contracts.

Exports to Satellites Off

Exports to Eastern European countries have fallen sharply as Washington closely screens export license requests. In June a dozen Russian satellites plus Russia received only $8.4 million of goods, compared with the first-six-month total to Eastern Europe of $110 million.

Production is Automatic on this

MORRIS MOR-SPEED Production Machine



● High production and low costs are essential under prevailing conditions today. To help you meet these conditions at favorable costs Morris has developed a line of Mor-Speed Production Machines.

Each machine is designed to handle a specific job and to obtain maximum production.

For example the Morris center column machine illustrated performs six operations—drilling—reaming—facing—spot facing—chamfering—and tapping simultaneously on automotive carburetor air horns. Thus producing a finished piece at every index of the fixture holding table.

Production is continuous as the twelve fixtures index automatically and operator unloads finished job and loads new piece at each index of the table.

If you are interested in high production and low costs consult Morris—they have the engineering experience and manufacturing "know-how" to design and build equipment to meet your specific job needs.

Write for complete details.

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Scotch Those Rumors

Rumors spread faster than smallpox. Sometimes they are circulated deliberately and maliciously; at other times they are bred by ignorance.

What to do about them is always a serious and perplexing problem of management. To deny them often lends dignity to stories which obviously are absurd and have no foundation in fact. To ignore them completely is to invite trouble.

At least one company of our acquaintance believes in meeting the problem head on. The manager for a long time has suggested that employees write in about rumors and find out whether they are true or not. He goes so far as to answer them to the best of his ability in public print.

He used to take space in the company magazine to print the rumor itself and then give the real facts. Now he goes a step further. He buys advertising space in the local daily newspaper once a week to tell the rumors and the real facts to the townspeople.

He isn't willing to let go unanswered the rumors passed around the town's barber shops, drug stores and pool rooms and exchanged across the back fences. He pulls no punches. He states the facts as he sees them. And he does not dodge any question, no matter how embarrassing it may seem (such as,"We hear the company is making far more profit than it should. How about it?").

The result is beneficial. The employees and their friends and neighbors know exactly where The Old Man and the company stand. They may take some of his answers with their tongues in their cheeks. But, on the whole, they respect his integrity and his honesty of purpose. Many stories which otherwise might fester and be very troublesome have disappeared by putting on them the white heat of the true facts.

This sort of treatment of rumors is much more effective than tilting one's nose in the air and refusing ever to discuss them. And it is better than writing letters to all the men or posting notices of denial.

Gossiping has few rivals as a means of entertainment. Rumors breed as rapidly as mosquitoes in a stagnant pond. We think that the company which deals forthrightly with such rumors concerning its affairs is taking the best course to scotch them.

The old days of secrecy in business are pretty much gone forever. More often than not, competitors go into each other's plants and see manufacturing processes. They keep few secrets from each other.

And management has few secrets today from its employees. The wise company will conduct its business in glass-cage fashion as far as its own employees are concerned. Attempts at concealment only cause trouble.

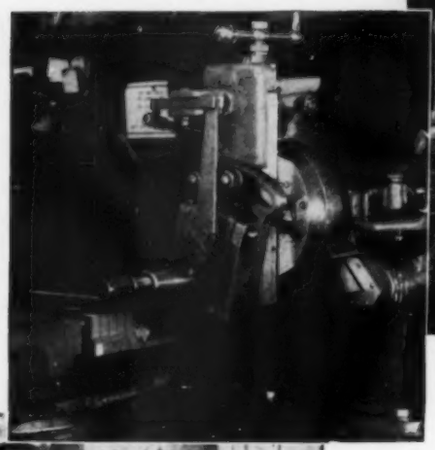
That is why the idea of inviting employees to bring rumors to management, with management's pledge that these rumors will be answered promptly and truthfully, has unusual merit.

Why not give this idea a trial?

Burnham Finney

EDITOR

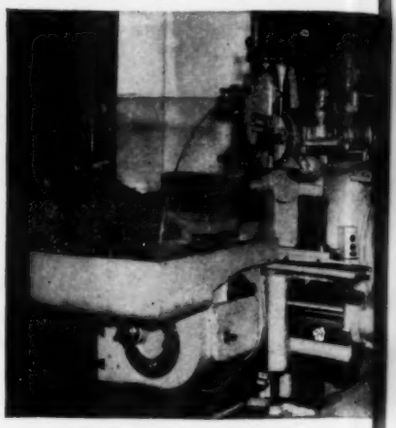
Power down feed speeds vertical facing and slotting.



Supplementary table top for extra large clamping space

Auxiliary front cross feed is very helpful for developing contours.

The Cincinnati automatic tool lifter is essential for carbide tools and high speeds.



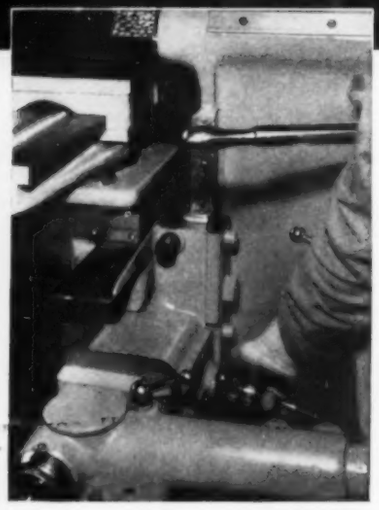
FAST SHAPING

...and wide utility, too!

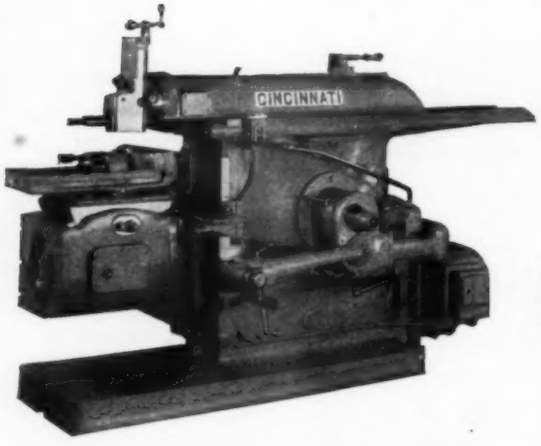
Powerful Cincinnati Shapers are tailored to your needs—the many features available to you will both speed your job and widen the use of a shaper in your shop.

Cincinnati Shapers are accurate, speedy and versatile. They are the handy man of industry.

Write for Catalog N-3, describing the many features and many types of Cincinnati Shapers available to you.



Power elevation to the rail, with all controls convenient to the operator, reduces setup time.

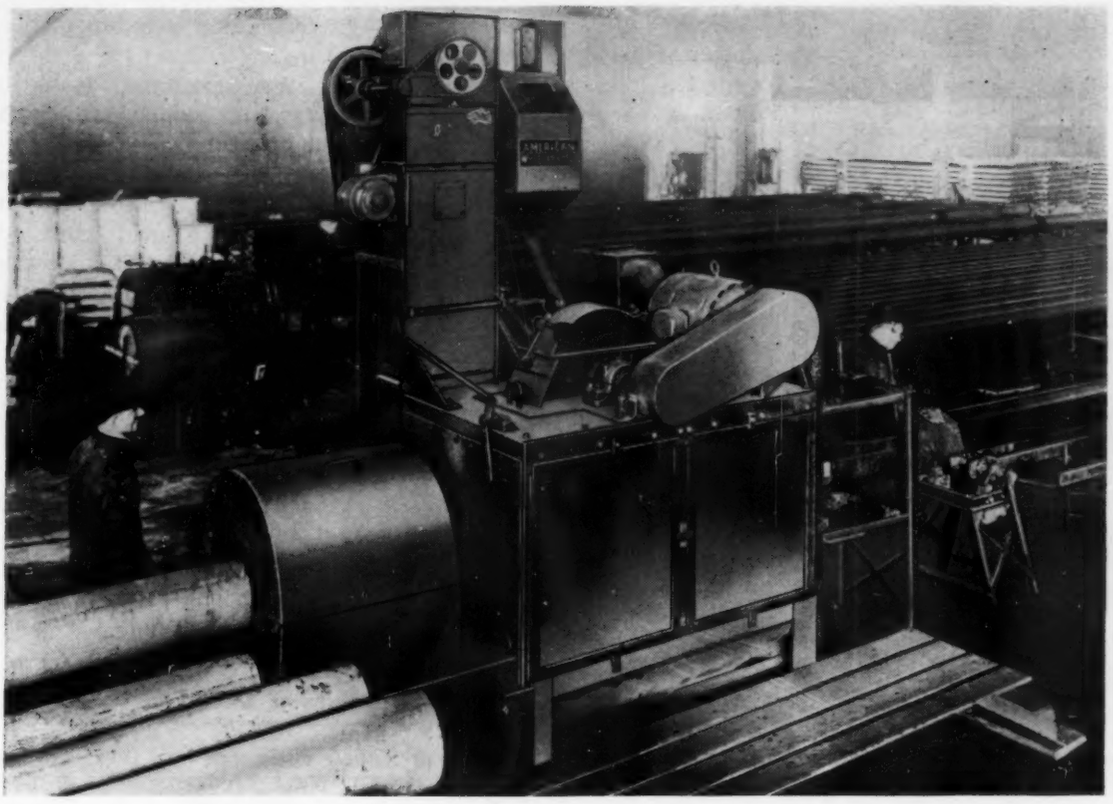


A Cincinnati Shaper with universal table is especially useful for tool room and die work.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES



Special cabinet for cleaning pipe before tarring and wrapping. Pipe enters the machine at the left and passes through an abrasive blast. Asphaltic coating is applied as pipe leaves cabinet at right

BLAST CLEANING PREPARES SURFACES FOR FINISHING

BY L. J. WIESCHHAUS, MARKET RESEARCH ENGINEER, AMERICAN WHEELABRATOR & EQUIPMENT CORP.

Removal of scale, dirt and other foreign matter prior to surface finishing can be done quickly and cheaply by abrasive blasting

ALTHOUGH virtually all finishing operations require some surface preparation, the type of preparation varies widely according to the finishing process used. The most common requirement is that the surface be thoroughly cleaned. This includes the removal of all oil and grease from the surface as well as the complete removal of all scale, rust, dirt and other hard and encrusted materials. There are many acceptable ways of removing surface impurities and the choice of any one or group of these is usually determined by the specific conditions of a given application. Abrasive blasting has found widespread application in this respect, and while it possesses certain limitations these are generally outweighed by its many advantages.

Metal Coating

Under this heading may be grouped those processes in which a layer of metal is applied for decoration, corrosion resistance or abrasion resistance. It includes such processes as electroplating, hot dip plating, metallizing and cladding.

In all cases of metal coating, it is extemely important that the surface be completely clean and free of scale, rust, paint and similar material. The desirable roughness of the surface, however, depends to a large extent upon the type of coating process used and the thickness of the coat applied.

Abrasive blasting has been used successfully for preparing the surface for most types of metal coating operations, but its widest

Aircraft engine cylinders are cleaned in a special cabinet immediately before metallizing. Blasting cycle is 65 sec. with No. 20 Alundum abrasive. Deep crevices between fins are thoroughly cleaned and roughened

application thus far has been for preparation prior to hot dip plating, especially on cast and forged products. It has, in some cases, resulted in the complete elimination of acid pickling, while in other cases a brief acid rinse is used as a precaution against abrasive dust on the surface and any possible rust formed as a result of handling between the cleaning and plating operations.

It is not always possible to eliminate the use of acid rinses in preparing parts for plating. This will depend to a large extent upon the treatment the parts receive after blast cleaning. If there is any appreciable delay or if the parts are handled by hand, there is always danger that rusting may have begun and the safest practice in these cases is to give every piece an acid dip before plating. It is believed by some operators that the acid rinse acts as a flux and insures a better plating, regardless of how carefully the material is handled after cleaning.

The effect of surface roughness on the bond produced is still a subject of considerable discussion and it is difficult at the present time to make any generalized statements.

Work done a few years ago by the New Jersey Zinc Co. on galvanizing indicated that where coatings capable of withstanding bending deformation are to be produced, the surface of the steel should be as smooth as possible. On the other hand, the Tin Research Institute in its publication No. 107 points out that "the tinning quality of a 'difficult' surface may be somewhat improved by roughening."

In discussing the mechanical preparation of cast iron surfaces prior to hot tinning, the Institute points out that iron castings have a hard skin containing a high percentage of silica and graphite which must be removed, and recommends mechanical preparation either by machining, grinding or blast cleaning.

For example, loads of small forgings which are cleaned in a batch type blast cleaning machine are galvanized directly after the cleaning operation and with no intermediate acid rinse. Cleaning time in this particular case ranges from 6 to 12 min. per load, depending on the type of part. The machine has a capacity of 11½ cu.ft. per load and the abrasive is a mixture of S230 and S330 chilled iron shot.

Cast iron parts for ice cream freezers are cleaned twice, once before grinding, and once after. After the second grinding, the parts are sent directly to the plating room for a tin or cadmium plating.

SAE CLEANING SHOT NUMBERS & SCREENING TOLERANCES

SHOT (SAE No.)	NONE ON SCREEN		MIN. ON SCREEN			MAX. THROUGH SCREEN		
	No.	Opening Inches	Per Cent	No.	Opening Inches	Per Cent	No.	Opening Inches
S 1320	4	0.187	85	6	0.132	5	7	0.111
S 1110	5	0.157	85	7	0.111	5	8	0.0937
S 930	6	0.132	80	8	0.0937	5	10	0.0787
S 780	7	0.111	80	10	0.0787	10	12	0.0661
S 660	8	0.0937	80	12	0.0661	10	14	0.0555
S 550	10	0.0787	80	14	0.0555	10	16	0.0469
S 460	12	0.0661	75	16	0.0469	15	18	0.0394
S 390	14	0.0555	75	18	0.0394	15	20	0.0331
S 330	16	0.0469	75	20	0.0331	15	30	0.0232
S 230	18	0.0394	70	30	0.0232	20	40	0.0165
S 170	20	0.0331	70	40	0.0165	20	50	0.0117
S 110	30	0.0232	65	50	0.0117	25	80	0.0070
S 70	40	0.0165	65	80	0.0070	25	120	0.0049

ABRASIVE GRIT NUMBERS & SCREENING TOLERANCES

GRIT	NONE ON SCREEN		MIN. ON SCREEN			MAX. THROUGH SCREEN		
	No.	Opening Inches	Per Cent	No.	Opening Inches	Per Cent	No.	Opening Inches
G 10	7	0.111	80	10	0.0787	10	12	0.0661
G 12	8	0.0937	80	12	0.0661	10	14	0.0555
G 14	10	0.0787	80	14	0.0555	10	16	0.0469
G 16	12	0.0661	75	16	0.0469	15	18	0.0394
G 18	14	0.0555	75	18	0.0394	15	25	0.0280
G 25	16	0.0469	70	25	0.0280	20	40	0.0165
G 40	18	0.0394	70	40	0.0165	20	50	0.0117
G 50	25	0.0280	65	50	0.0117	25	80	0.0070
G 80	40	0.0165	65	80	0.0070	25	120	0.0049
G 120	50	0.0117	60	120	0.0049	30	200	0.0029
G 200	80	0.0070	55	200	0.0029	35	325	0.0017
G 325	120	0.0049	20	325	0.0017			

The abrasive used in the case is S390 shot.

In the case of metallizing, where molten metal is sprayed onto the part, it is again essential that the surface be thoroughly cleaned. In addition, it is usually desirable to have an extremely rough surface, and for that reason, rough machining is frequently recommended on parts of suitable shape and construction. In cases involving large production, or where intricately shaped parts are to be metallized, blast cleaning has been used with good results.

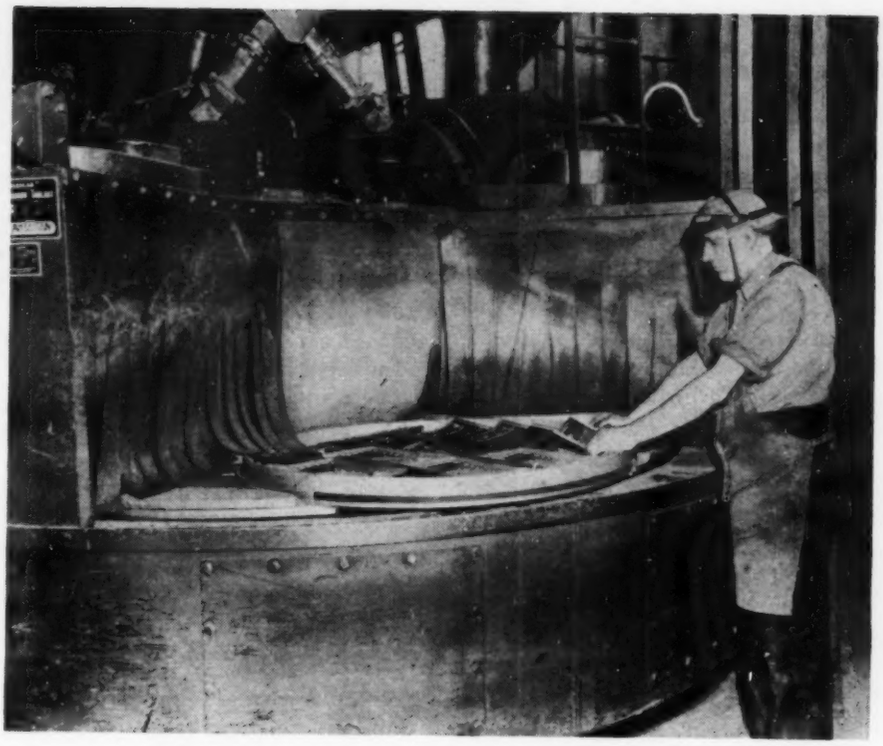
In electroplating, it has been found desirable to use a relatively fine abrasive if a mirror-like, decorative finish is desired. In considering parts to be electroplated, it should be realized that blast cleaning actually increases the surface area of the metal and thereby raises the minimum current density required for coverage.

Bearing inserts which require a very fine finish prior to silver plating are cleaned with G50 grit with a cleaning time of 12 min. per load.

Blast cleaning in the preparation of surfaces prior to cladding operations, as well as in the manufacture of terne plate, offers a possible further application. These operations are so similar to many of the other plating and bonding operations where blast cleaning is successfully used that it seems likely the process would be readily applicable. Extensive tests would be necessary, however, before the actual advantages of such an application could be determined.

Non-Metallic, Inorganic Coating

Under this heading falls a tremendous variety of proprietary and general processes, most of which have their own special trade names and vary in some slight degree from each other. These include such treatments as anodizing, Bonderizing, Dichromating, Iridditing, Parkerizing, Cronak treatment, Jetal and Oxidine treatments, Alumilite finish, and many others. In general, these all operate on the same principle, in that the work is treated in such a way that the surface layer of the metal combines with other elements to form an oxide, chromate, phosphate or other compound. This adheres tightly to the base metal and provides a corrosion-resistant surface that may be left in that form or used as a bonding agent for some subsequent finishing operation.



Stove grates are blast cleaned on rotary tables in indexing machine. Chilled iron grit G25 and G40 is used, and parts pass directly from cleaning to enameling without any intermediate treatment

Regardless of the exact type of process used, one consistent requirement is that the surface be thoroughly cleaned before application of the coating.

Blast cleaning can be, and has been, used in conjunction with most types of coatings in this classification. The use has been primarily for the purpose of cleaning the surface and the slight surface roughening has little or no effect on the permanence of the finish.

When considering the application of blast cleaning prior to the use of any of the non-metallic coatings, it should be remembered that the final surface produced follows in detail the surface irregularities of the parts prior to treating. In many cases the fine, matte finish produced by the abrasive blast is entirely satisfactory and may even be highly desirable for decorative purposes. However, in case a highly polished finish is desired, some intermediate buffing or polishing is necessary. It should also be recognized that in metal coloring operations, the higher the finish or polish of the metal, the richer the color it will take. Conversely, the rougher the surface the duller or weaker the color will be.

Certain precautions are necessary in many cases to avoid surface contamination from the abrasive used.

The Parker Rust Proof Co. recommends that parts to be Bonderized be given a hot water rinse after blasting to remove most of the slight surface accumulation of iron dust.

In cases where abrasive blasting is done on magnesium prior to chrome pickle or dichromate treatments, Dow Chemical Co. recommends that the part be given a chemical treatment or chromic acid pickle to remove the effects of surface contamination by the abrasive.

For some applications involving nonferrous metals, the use of iron abrasives may be undesirable because the abrasive particles left on the surface form discoloring products of oxidation. In these cases it may be desirable to use sand, Carborundum, copper shot, or other materials.

During the war, Bren Gun mag-

azine cases were cleaned in an 11½-cu.ft. Wheelabrator Tumblast prior to Parkerizing. Production was 250 clips in 15 min. Abrasive was G50 and G120 chilled iron grit.

Surface Impregnation

In this category are those processes in which some alloying element is added to the surface of the metal. This is usually done to increase wear resistance or corrosion resistance and includes such processes as Sherardizing, Calorizing, Chromizing, Ihrigizing, Nitriding, carburizing and cyaniding.

In considering the application of blast cleaning to this class of surface treatment, it is difficult to generalize because of the widely varying requirements of the different processes. About all that can be said in a general way is that blast cleaning is helpful in some cases and unnecessary in others.

In order to get some reliable information as to the type of surface preparation required for each of the better known surface impregnating processes, a survey was conducted among the recognized authorities on different processes. The follow-in is a resumé of the comments received and will serve to indicate the application and limitation of blast cleaning in each specific case.

Calorizing. Steel to be calorized must be free from scale, grease or other foreign substances. "When the cleaning operation is performed by sandblast, we prefer a fine abrasive so that a smooth surface is secured. Any roughening of the surface is reproduced in the calorized finish."

Chromizing. When blast cleaning is used to prepare a surface prior to Chromizing, it is recommended that Carborundum or chilled iron grit be used. The use of sand is not recommended because any particles which adhere to the surface might interfere with diffusion of the chromium. Even where Carborundum or chilled iron is used it is necessary that the adhering grit be carefully removed prior to the Chromizing operation. The surface should not be too rough and for that reason a fine grit size is recommended.

Ihrigizing, (Siliconizing). This process requires no special surface preparation "except to remove burned-in sand from castings. It is not even necessary to pickle off rust or light mill scale from the parts."

Sherardizing. Blast cleaning provides an ideal finish for sherardizing and is usually recommended. The main purpose in using blast cleaning is to provide a clean surface but it is also felt that the bond is improved by the slight roughening of the surface. In most instances a fine grit is recommended.

Carburizing, Nitriding, Cyaniding. Blast cleaning is seldom, if ever, necessary as a surface preparation for these treatments. This is due primarily to the fact that most surface hardening operations are performed on finished or semi-finished parts. In general it appears that surface cleanliness is not too important in these operations unless there is a heavy scale such as appears on hot-rolled material or rough forgings. "It is true that a scale or surface condition which is rough will cut down the effect of satisfactory carburization. At any rate, parts in this condition will not carburize uniformly."

Organic Coatings

In this classification may be included paint, lacquer, enamel and the various resinous and asphaltic coatings. For convenience, porcelain enamel may also be included, even though it is not an organic coat.

This classification represents one of the widest and most generally accepted applications for abrasive blasting. All coatings in this group require thoroughly cleaned surfaces and, since they generally have a certain amount of filling action, the slight surface roughness is no disadvantage from the standpoint of appearance. Indeed, in many cases the gripping action provided by this type of surface greatly increases the strength of the bond between the coating material and the base metal.

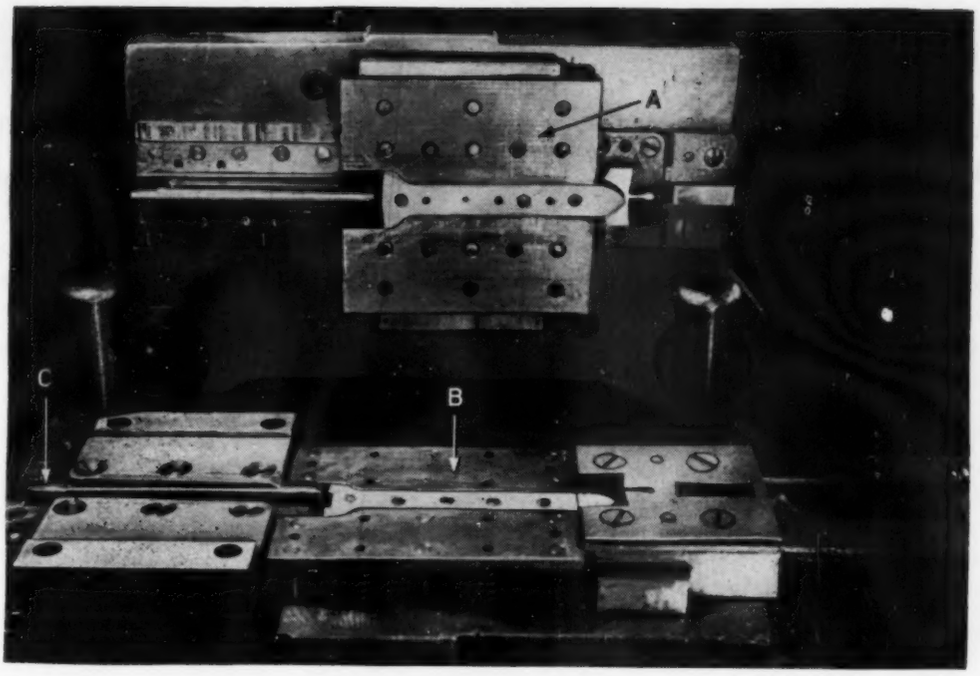
Pipe is cleaned prior to coating with an asphaltic compound. A mixture of S390 shot and G25 grit is used to prepare the surface. The cleaning time varies according to the size of the pipe and, in cabinets employing one Wheelabrator unit, 6-in. pipe has been cleaned at a speed of 22 fpm., whereas 10- and 12-in. sizes have a maximum cleaning rate of approximately 14 fpm. A conservative estimate of the cleaning rate on pipe is approximately 30 sq. ft. of surface per min. per wheel.

Equipment Used

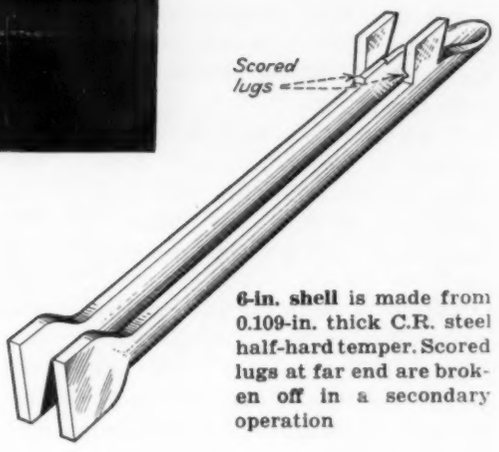
Abrasive blasting can be broken down into two main classifications depending upon the method used in propelling the abrasive. These are either air blast (using compressed air) or airless blast (using centrifugal force) and each has certain advantages and specific applications. Airblast is the older method; it is considerably slower and more expensive in operation. However, it has the advantage of representing a lower initial investment in those plants which already have an adequate supply of compressed air and it finds many applications in such plants where a limited number of parts are to be processed.

Airless blasting, on the other hand, is used primarily in relatively high production requirements; it provides a more uniform surface and is considerably less expensive to operate, although the initial investment may be higher. In airless blasting, the abrasive is hurled by means of a bladed wheel and may reach a velocity in excess of 12,000 fpm. One such wheel will throw between 300 and 500 lb. of abrasive per min., thus insuring complete and thorough coverage of the work in the abrasive blast, while the scouring action of the abrasive effectively removes every trace of foreign material.

The abrasive used in either type of blast cleaning equipment is usually a chilled iron grit or shot, although in some cases it may be Carborundum or a good grade of silica sand. The chilled iron abrasive has greater striking force, hence more cleaning power, and results in much less wear on the cleaning equipment. Because of the possibility of metallic abrasive dust contaminating the surface and/or causing discoloration, the choice of abrasive for any finishing operation should be given careful consideration by the user.



Progressive die at first position stamps trade-mark on strip, pierces wings, and scores the lugs that connect blank to strip. Scoring punches (not visible) penetrate stock approximately 0.055 in. At the second position, die blocks *A* operate against spring pressure pads *B* to trim scrap from the strip, thus shaping the blank. With the return of the ram a blast of air blows the scrap clear. At the third position, blank locates in the nesting plate *C* and the shell is formed



6-in. shell is made from 0.109-in. thick C.R. steel half-hard temper. Scored lugs at far end are broken off in a secondary operation

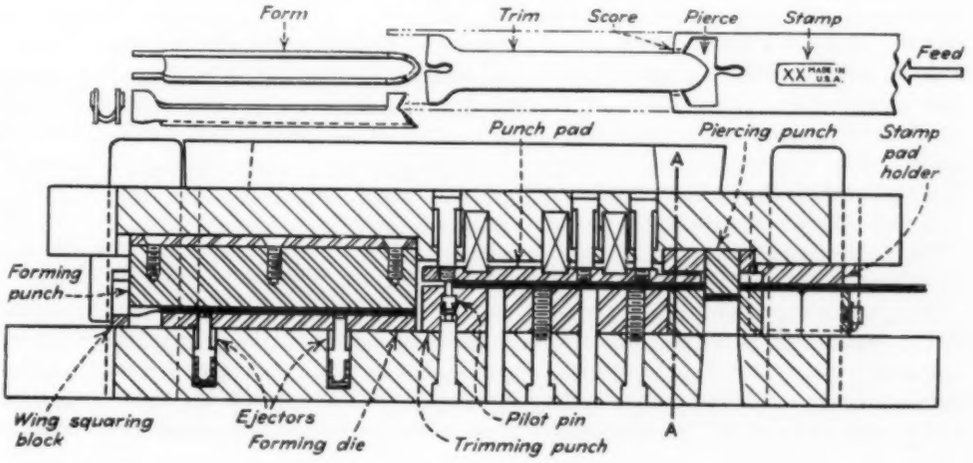
PROGRESSIVE DIE SCORES, TRIMS AND FORMS HEAVY SHELL

BY THEODORE OSHINSLY, Chief Tool Engineer

How to advance the blank and how to remove the material required for this purpose presented a problem in the design of the progressive die pictured.

Advance is made possible by trimming in the second position in such a way that two lugs are left to connect the blank to the strip. As the blank lies in the third position just prior to forming, these two lugs are sheared from the strip but remain attached to the shell. Their removal requires a secondary operation. To simplify this operation, chisel-like punches in the first die position score the metal from which the lug will be formed. These punches, made of drill rod and adjustable without removal of the entire punch pad, are set to penetrate to approximately one-half the thickness of the strip. This scoring enables breaking off the lugs readily in the secondary operation. The shell is placed on its concave side over a $\frac{5}{8}$-in. rod and the lugs are tapped with a mallet.

Since completion of the die approximately 50,000 shells have been produced with little signs of wear on the scoring punches.



Blank development and cross-section of the die in the shut position show the strip in its three progressive stages. Scoring punches in the first position are located at *A-A*. At the second position the spring-loaded ball-point pilot-pin enters the pierced hole to locate the strip. After forming in the third position, the shell is forced to the surface by spring-loaded pins and is blown from the die with air

IS STATISTICAL QUALITY CONTROL

"NO!" *says Chief Tool Engineer Bryan D. Miller, who relates an actual experience and comes forth with an indictment*

"THEY'RE having trouble on the automatics with the rim diameter of the end brackets, Jim," I announced to Smith, our new trouble shooter. "Go down to Dept. 3 and see what we can do to reduce the rejects."

The trouble was probably minor. Perhaps a slight machine adjustment, compensation for wear in the toolholder or chuck, or change in material would correct the condition.

That afternoon Smith was back at his desk. The stack of papers filled with figures and the slide rule in his hands assured me that he was on another job. No doubt he had readily located and corrected the factors which were making it troublesome to hold size on the 0.002-in. tolerance dimension.

Holds Up Assembly

It was somewhat of a surprise, then, the following afternoon when the Sup't. called: "When are you fellows going to do something about the trouble on the end brackets? If we can't get that condition corrected soon we'll be short of good parts for the assembly line."

"Just a minute," I interrupted, "I put Smith on that right after you called me yesterday morning and I'm sure he's taken care of it. Fact is, he's working on something else now."

"Well, it's not taken care of—we're still making scrap." The Sup't slammed down the receiver.

I went over to Smith's desk. "How's the end-bracket job going?"

"Oh, we're making fine progress, sir. I borrowed a man from the inspection department and with his help we're going to solve this difficulty once and for all. We're using the principles of statistical quality control," this last smugly, with the proud air of an educated man using words his listener is certain not to understand.

"Statistical quality control?" I had the same feeling you get just before a high-pressure salesman puts on the bite.

"Sure, haven't you heard of it? It's the latest thing. Here's the way we work. All through yesterday, after I got the inspector, we visited the machine every half hour and measured five pieces, each to the fourth decimal place. These five figures we added together and divided by five—that gave us the average—then we took the highest reading and subtracted the lowest reading from it—that gave us the range. Late this morning we took all these ranges and added them, divided by the total number and got the average of the ranges. The answer is 0.00121 in. We drop the 0.00001 in. It's not significant, you know."

I agreed—more than he knew.

"Now we use our formula," he continued. "The average range which we designate as $\overline{R}$ is important here. Our formula states tolerance spread must be equal to or greater than $\frac{6 \times \overline{R}}{d^2} \bullet D^2$ is the dispersion factor. It depends on the size of each sample. For the sample group of five this factor is 2.326. You get that figure from the fellow who thought this up. Now we work out the formula and we get, tolerance spread

$$= \frac{6}{2.326} \times 0.0012 = 0.0031 \text{ in.}$$

"Ha! Ha!—there it is. That formula shows that the way we've been running, the 0.002-in. tolerance is not enough. To avoid excess scrap, the print should give 0.0031-in. tolerance. But we can't do that, so by reversing the above formula we find that we could get by with 0.002-in. tolerance if we had instead of our present average range of 0.0012 in. an average range of 0.000775 in. (the last figures are significant). There's no doubt about it. I think we've proved that the operation will have to be improved."

"But I told you that yesterday morning, after the Sup't. called me," I faintly replied, stifling my rage.

Each generation must suffer its "statistic-itis" but until recently the hard-headed manufacturing industry had not been too grossly affected.

Requires Ingenuity

Returning to our shop problem: It would appear to me that the tedious recording compiling, adding, dividing and formula solving which are the core of the "statistical quality-control method" are merely refinements of inspection procedure which add little value to successful manufacturing operations. A glance at any scrap report will tell supervision that a difficulty exists. An alert foreman may convey the same information. Once the existence of trouble is recognized it becomes the engineer's or troubleshooter's problem to determine the underlying dynamics and attempt remedial action. No figures, formulas or calculations help him here. A machine is made to do a specific operation—maintain a definite tolerance. When something goes wrong—experience, intelligent insight, ingenuity—provide the solution. There is no satisfactory substitute for these.

OF VALUE IN MANUFACTURING?

"YES!" *says Quality Control Engineer Clifford W. Kennedy, who comments on the experience and defends the statistical method*

STATISTICAL analyses will show *what* is happening; often, of course, they may not show *why;* but frequently they help to set our thinking straight. One way of geting acquainted with a strange city is to make inquiries and keep driving around until you get to know your way. Usually, however, a glance at a street map makes the process much easier and more direct.

In quality-control work we run up against both ends of the human spectrum. There are the unconvinced and there are those who allow their enthusiasm to carry them too far over the borders of the practical.

Most quality-control methods have a statistical basis, a mathematical foundation. So do trig tables. Unfortunately quality control has many times attracted the type of man who relishes solving a simple problem in arithmetic with algebra or calculus. Actually, it seems better to keep the natural amateur statistician out of the shop as soon as he is discovered.

Learn All Techniques

If statistical quality-control techniques are to be applied, it is better to be acquainted with all of them. Some have exceedingly practical applications and get results in a few minutes; others as far as being pertinent to a particular situation is concerned, are essentially mathematician's dreams. If your car persists in squeaking even after a grease job, it would seem more sensible to check on the grease monkey than to send a sample of the grease out for chemical analysis. One of the hard lessons a quality-control man needs to learn is when *not* to use statistics.

There are practical statistical techniques for analyzing a trouble better, quicker and cheaper than the average range, $\overline{R}$, and the $6\overline{R}/d_2$ business. This formula, however, is practical and useful for setting up a condition in relation to specified tolerances, within which the natural variations of the job must operate to avoid scrap or rework. Practical control limits are set up so, as the job proceeds, accurate determination of the product condition can be made from examining small samples of three, four or five pieces every half hour or so.

Gives Warning of Trouble

Furthermore, statistical methods in inspection can be made to prophecy; to show that if the present course is continued, scrap and rework will result. A glance at a scrap report tells the same story, true; the major difference is that then the horse is dead.

An excellent case in point is an experience in the International Harvester Fort Wayne works with drop-forge die life. The variable or "characteristic" or "statistic" is the weight of flash on the forgings, the general basis being that increased flash is an indication of die wear. Traditionaly, the decision over the time to take a die out and dress it was left to the operator and his foreman. Usually the die was left in too long and had to be replaced with a new one.

Then the job was attacked with $6\overline{R}/d_2$ and related quality control techniques. Statistics were substituted for opinion and control charts were set up. By taking a die out in time when the control chart rings the bell (which means repairing dies a little more often than heretofore), die life has been increased at least tenfold. In fact, dies now last so long that the present problem is to secure die beds that do not finally crumble from sheer metal exhaustion. Annual money savings in this one item alone are listed in the hundred thousand dollar bracket.

Aids Solutions

This is not an isolated occurrence. While trouble admittedly can be located without charts or so-called frequency distributions, the quality control approach frequently acts like a catalytic agent to traditional trouble-shooting procedures by emphasizing conditions as they are.

On the whole the greatest value from routine quality control methods (with statistics and a little arithmetic always in the background) is to be obtained from their ability to detect quickly, cheaply and accurately the undesired variation in the established and intended process in its day to day operation. Every job has its own peculiar pattern of variability; duplication is impossible. We all admit this. In fact, it is the explanation of tolerances. But if we can know in time that a job is reaching again that inevitable stage of producing sub-standard work, we can do something about it. Quality-control methods point out the need for preventive action. The responsible individual, however, must use good sense in selecting the proper remedy.

While industrial statistics and quality control are actually celebrating their twenty-fifth anniversary this year they are new to most of us, and as with anything else new perhaps we should approach the use of them with a little of the Quaker pholosophy. They, the Quakers, have a saying: "It is better to light a candle than to curse the darkness."

Marmon - Herrington trolley coach features light-weight, stressed-skin body construction made up principally of aluminum alloys. Improved operating characteristics and better driver's vision are also obtained. A single electric motor, mounted longitudinally at the rear, drives Timken double-reduction, full-floating rear axle through needle-bearing type propeller shaft

AIRCRAFT FIXTURES MAKE TROLLEY-COACH ASSEMBLIES

Large unit subassemblies feed progressive assembly line.

Side walls, rear end section and roof section

move from separate feeder aisles to correct stations on the lines

BY SETH C. KLEIN,

Vice President in Charge of Production
MARMON-HERRINGTON COMPANY

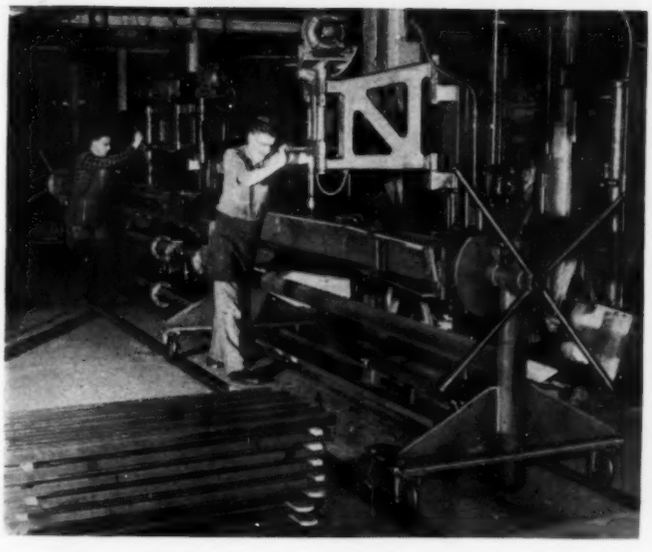
Now being made by Marmon-Herrington Co. is a series of lightweight trolley coaches with body design utilizing principles of stressed-skin construction perfected during the war by aircraft designers. Also adapted from the aircraft industry by Marmon-Herrington engineers is the basic idea of constructing sidewalls, roof, and front and rear end subassemblies as completed units on fixtures set apart from the final assembly line. These units are moved by crane to the assembly line and mounted on the underframe to form a unit.

Full-length 7-in. pressed-steel center sills form the backbone of the underframe. To these sills are riveted cross-members to form the base on which the coach body is assembled. Corrosion-resistant steel cross-members, or bolsters, are provided at spring-brackets and other highly stressed positions. Aluminum-alloy cross-members are used in the underframe where weight can be saved without sacrificing strength or durability. At all points where aluminum-alloy and steel members are joined together, the joints are insulated with Aluminlastic paint or Dolphinite sealing compound.

Body sidewall construction is unique, as both the inside and outside sheathing are designed as stress-carrying members. Posts and carlines are press-flanged channel sections of No. 16 gage steel, 1¾ in. deep. Outside and inside roof and side sheets are aluminum alloy, and aluminum-alloy ventilating ducts are built into the roof subassembly.

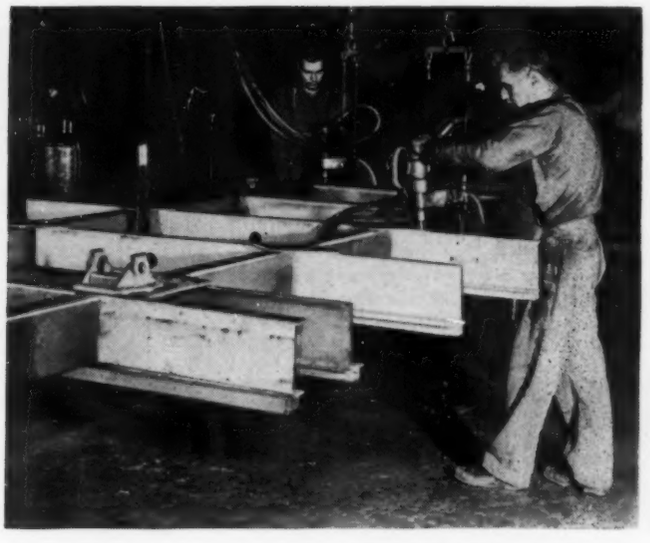
Green assembly line for trolley coaches is located in a high-bay area of the main plant. 425 ft. long and 60 ft. wide, this section is served by a 15-ton overhead traveling crane. The coaches are set crosswise of the bay to conserve space and to reduce the distance each unit must be moved as it progresses from station to station along the assembly line. The first two stations consist of fixed alignment blocks upon which the underframe is assembled and rivet-

1 *Green assembly line* for Marmon-Herrington trolley coaches consists of 12 stations. Starting with assembly of the underframe at station 1 at far end of bay, units are built progressively until at station 12 they are at the stage of completion illustrated by coach in the foreground. Coaches next are moved to paint spray booths at left and then on to the final assembly line. Sub-assemblies are built in nearby feeder aisles. 40-, 44- and 48-passenger coaches pass through this line



2 *Drilling full-length sills* for underframe of trolley coach is done in a jig supported by four trunnion bearings on special carriage that is movable along floor tracks. All holes in the 7/32-in. thick pressed channels can be drilled with the two "broken arm" Foote Burt radials.

The one jig holds both the right- and left-hand sills required for each coach and is adjustable to take the different lengths required for each of the three sizes of coach. Both the jig and the two lengths of 5-in. dia. pipe that form the longitudinal members of the carriage are fitted with couplings so spacers can be installed for the different lengths. The carriage consists of two units, each supported on four casters

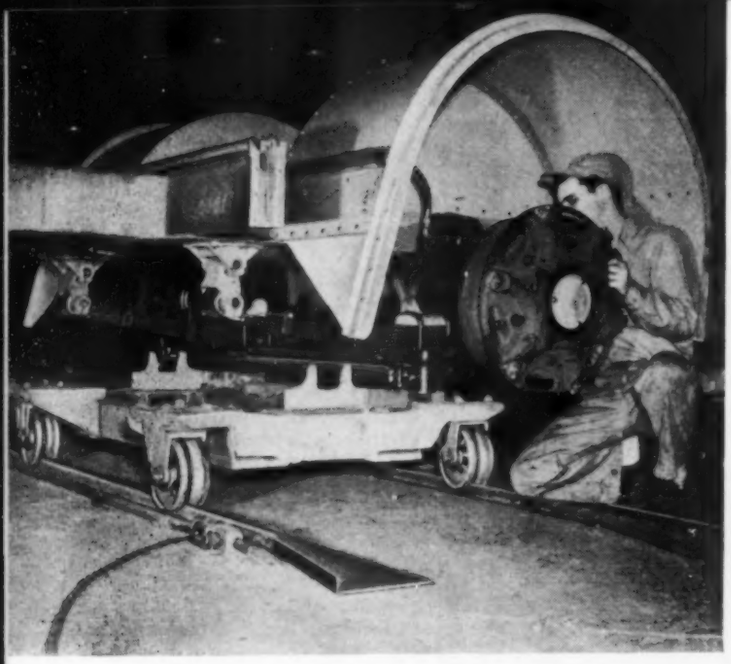


3 *Underframe assembly* is built on first two work stations of green assembly line. Right- and left-hand sills are positioned, then steel and aluminum cross-members are fitted in position with gussets before riveting. Airdraulic squeeze riveters are used. Small rivets are set cold, large rivets are heated in resistance units

ed. At the other ten stations, the underframe is supported on two four-wheeled dollies that are moved along tracks when the supported assembly is to be moved to the next work station.

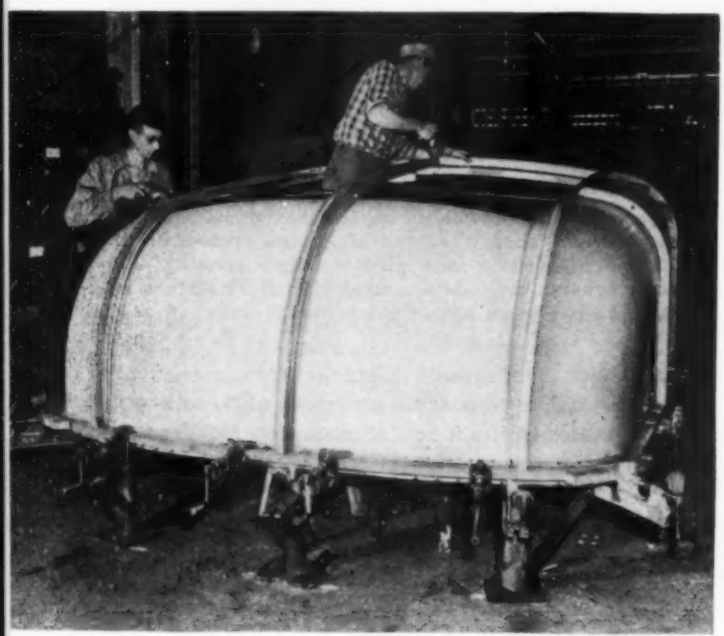
At the end of the green assembly line are switches to transfer both dollies onto a single track at right-angles to the assembly-line tracks. Now traveling in a direction parallel the length of the coach, dollies are moved out of the high bay into a paint spray booth. Two booths with a track through each are provided. Finished coaches move out of these booths on the dollies to the first station on the final assembly line. Here, wheels and tires are mounted on the axles, and the dollies are removed for return to the green line. On the final assembly line all interior and exterior fittings are mounted, including lights, seats, and the trolley assembly which is mounted on the roof.

Work stations throughout the trolley-coach department have been arranged so work is distributed equally for men working at each station, thus making for maximum labor efficiency. More than 400 coaches have been produced in the year and a half since the first unit was moved off the line.



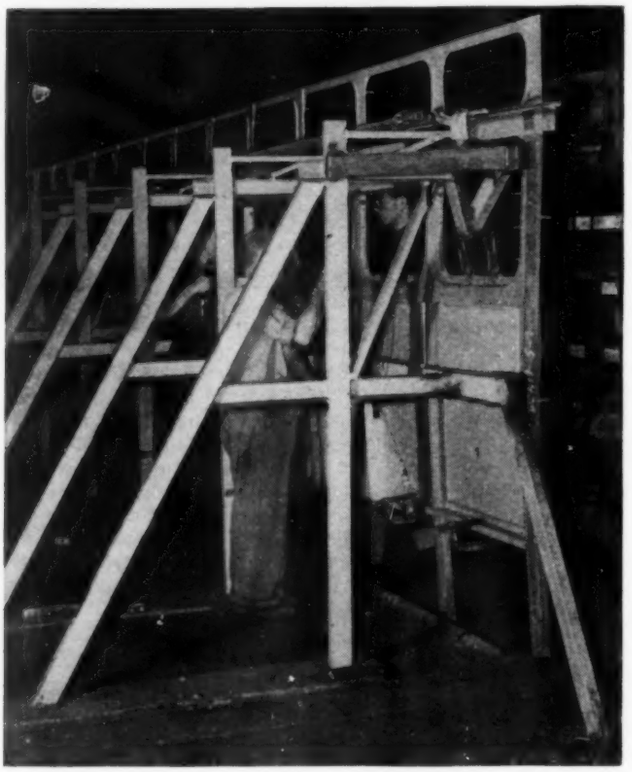
4 *Wheeled dollies,* loaded with front and rear Timken axles, complete with wheel centers and brake assemblies, are moved to tracks at third assembly station on green line. Ramps permit easy movement of dollies onto rails. Center position of dolly holds axles for 44-passenger coach while outside position holds axles for other two sizes. Dollies are reversed on tracks when 40- or 48-passenger coaches are to be made. Wheels are standard 6-in. dia. grooved Bassick casters in swivel mounts

Rails are 42 in. between centers and consist of inverted 1½-in. rolled steel angles welded to ¼x4-in. steel strips bolted to floor. Tracks at opposite ends of underframes are 235 in. between centers, wheelbase length of the 44-passenger coach. An electric conduit parallels inside rail of one track while a compressed-air line parallels inside rail of the other. Outlets are provided in each line at each of the 10 work stations along the tracks, so portable power tools and lights can be connected as needed

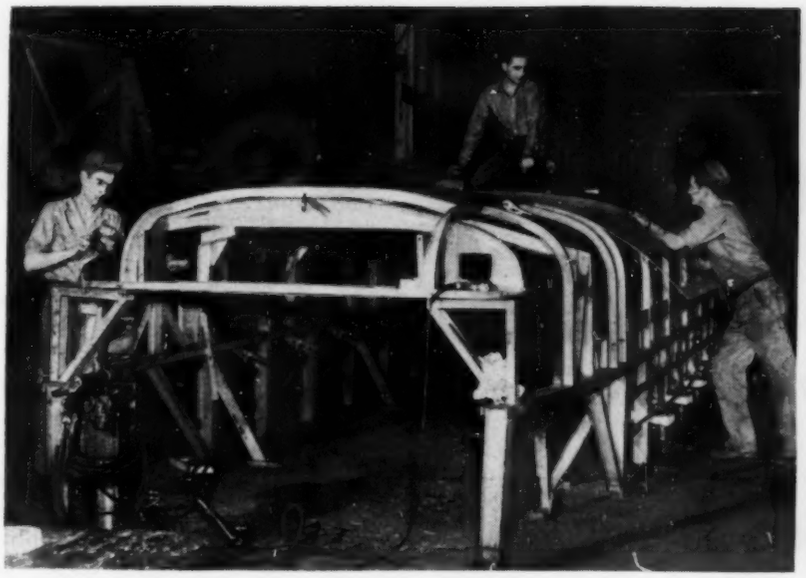


6 *Rear-end subassembly* for trolley coach body is assembled and riveted as a complete unit on this floor-mounted fixture in feeder aisle beside green assembly aisle. Screw clamps and straps hold posts, carlines and aluminum sheets in position for drilling and riveting. Fixture is made of steel sections and formed wood blocks

5 *Special leveling posts* keep underframe in accurate alignment at each assembly station until sidewalls, roof and two end sections are positioned and riveted into a solid structure. Hydraulic jacks raise underframe while posts are positioned

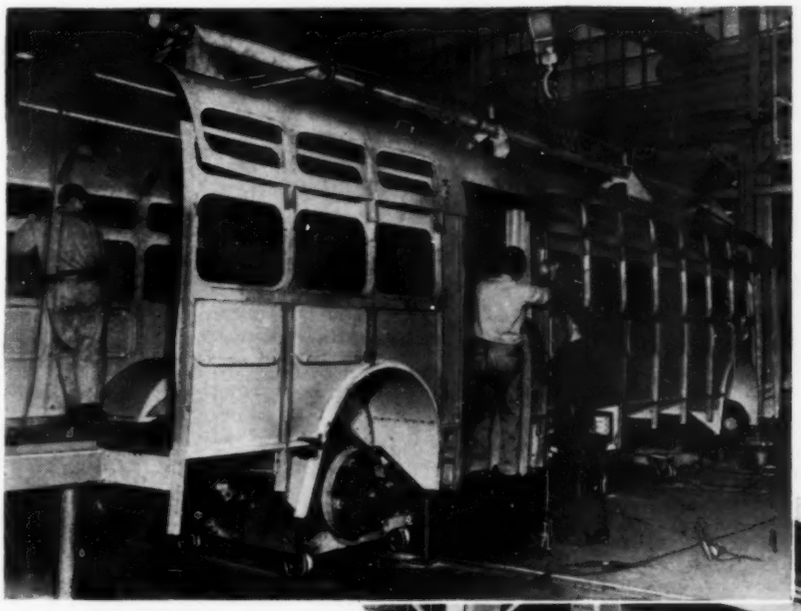


7 *Body side walls* are built on welded steel structures. There is one of these assembly fixtures for right- and one for left-hand wall assemblies. Clamps hold posts and carlines in position for mounting, drilling and riveting side wall sheathing. Fixture design permits a number of assemblers to work on each unit at same time



8 *Roof member* is assembled in a floor-mounted fixture of proper height to permit workers to move about fixture easily. Portable Air-draulic power unit supplies pressure for squeeze riveters

9 *Roof sheets* of aluminum are pulled tight against frame by air cylinders on floor along one side of roof assembly fixture. This is done before drilling and riveting. Tension is applied by steel straps and flexible chain members having leather facings to prevent scratching soft sheets when power is applied. Each cylinder has individual control valve

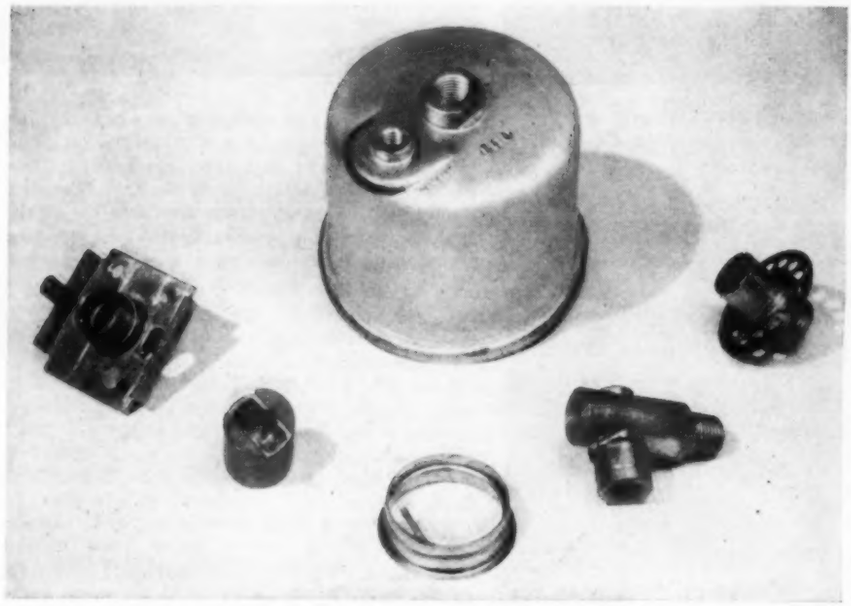


10 *Special hoist unit,* carried by 15-ton overhead crane, holds roof during mounting on coach sidewalls. Several men guide roof in alignment with sidewall posts as it is lowered into position

11 *Final assembly line* includes final fitting, touch-up and inspection operations. At end of line is submerged railroad track where trolleys are run directly off assembly floor onto flat cars for shipment. Before moving to final assembly, coaches leave paint spray booth, have wheels and tires mounted and are lifted from the green assembly-line dollies

Furnace-Brazed Assemblies Replace One-Piece Units

Typical jobs at American Bosch exemplify good practice that will guide others in similar cost-reducing applications



Converted parts exemplify the range of problems solved by furnace brazing. One was changed to improve quality, another to save material, still another to increase production, a fourth to avoid difficult machining operations

BY H. M. WEBBER

Industrial Heating Division
Apparatus Department
General Electric Company
Schenectady, N. Y.

AMERICAN BOSCH CORPORATION, Springfield, Mass., has found furnace brazing a useful tool for increasing production, improving quality, and reducing costs on many steel parts. Numerous units originally forged, cast, or machined from bar stock are now assembled from less expensive punch-press and screw-machine parts and furnace brazed with copper in controlled-atmosphere electric furnaces. In addition, other fabricating methods, such as torch brazing, have in some instances been replaced by electric furnace brazing.

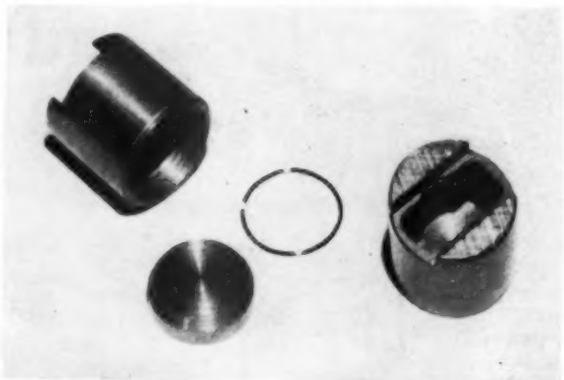
Each year, hundreds of thousands of these copper-brazed subassemblies are built by American Bosch into accessories for diesel and gasoline engines. Such accessories include magnetos, fuel-injection pumps, generators, ignition coils, and starting vibrators. Typical uses are on automobiles, trucks, tractors, industrial machinery, buses, airplanes, and ships.

No compromise with quality can be made in fabricating assemblies for such a wide diversity of applications. The assemblies must be strong to withstand high stresses, vibration, impacts, widely varying temperature conditions, and in some cases neglect and abuse. Certain assemblies require tightness for gases or liquids, and they must remain tight throughout their lives.

Nine years of experience in furnace brazing have proved that fabricated subassemblies meet all requirements fully and, in general, enable substantial reductions in cost. From scores of different furnace-brazed assemblies in such service, a few typical ones will be described.

Formerly Forged

The tappet shell below, when made from a forging, was a relatively expensive item to produce. It was a difficult part to forge because of the rectangular-shaped, hollowed out center. Deviations from specifications for the inside of the forging were common, and minimizing



Tappet shell, formerly forged, is now made of two screw-machine parts and copper brazed. Sectional view shows location of the brazing ring

the variation required extra care in manufacture.

Subsequent machining was both difficult and costly. First the forging had to be machined all over. Then the odd-shaped hole in the center was machined to size by a laborious end-profiling operation.

Now the part has been redesigned for furnace brazing. It consists of two parts, body and disk. These are made on screw-machines, assembled in presses with copper-wire rings preplaced in the joints, and furnace-brazed in large quantities. As a result, routine manufacturing difficulties have been completely overcome, parts are made simply and accurately, and over-all cost has been greatly reduced.

Tappet shells are made in several sizes. That illustrated is about 1 in. in dia. by 1 in. long. Bodies are made from 1-in. dia. bar stock of C-1118 manganese carburizing steel. While on the screw machines, bodies are drilled through and counterbored at one end to receive the disks. After being cut off, a number of bodies are lined up together, end to end, and the odd-shaped rectangular hole is broached through the gang simultaneously. Then the bodies are lined up side by side, and the slot on top is broached in similar fashion.

Disks are also made on screw machines from 13/16-in. C-1118 bar stock with one corner heavily chamfered as shown. The counterbored hole in the body and the outside diameter of the disk are machined with tolerances to give 0.001- to 0.003-in. press fit. It has been found that light press fits rather than loose fits give best strength and uniformity in the furnace-brazing operation.

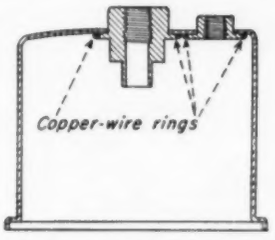
Rings made of ordinary 0.032-in. copper wire are placed in the counterbored ends of the bodies. Then the disks are pressed in, with the chamfered corners providing recesses for the brazing metal.

Locking the brazing metal within the joint in this fashion, or by some other method, such as inserting it in grooves cut for the purpose, has been found ideal for furnace-brazing work. Thus the brazing metal cannot get away, such as by warping, by flow due to gravity, or by misplacement during handling in the shop. It is held definitely in place, and has no alternative but to flow into the joint for which it is intended.

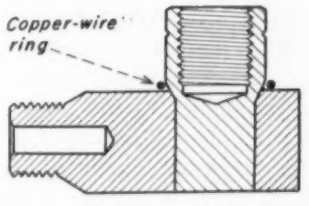
Tappet-shell assemblies are loaded, disk down, into 11x32-in. trays, 147 per tray. Each trayload rests in the heating chamber of the furnace about 15 minutes. The copper melts creeps through the joints by capillary attraction and forms strong alloys with the steel. No flux is necessary because the controlled atmosphere within the heating chamber serves the same purpose as a flux by reducing oxides, cleaning surfaces, and promoting wetting by the molten brazing metal.

The trayloads of work are then cooled in a water-jacketed chamber in a protective atmosphere. Parts emerge clean and bright, with smooth, neat fillets of copper, and an immeasurably thin film of copper spread over the surfaces of the steel near the joints.

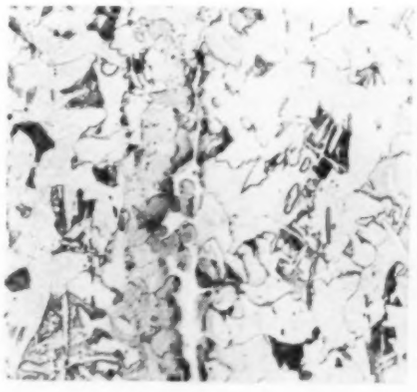
After furnace brazing the tappet



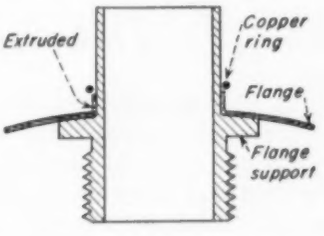
Fuel-oil filter can is an assembly of a deep-drawn steel cup and two inserts that have wide flanges to give large brazing areas. Inserts are pressed into position and staked before brazing to hold them firmly in place



Leak-off valve, formerly a casting, was converted to a furnace-brazed assembly to minimize leakage. Copper ring is on top of joint and molten copper flows downward



Copper-brazed bond between disk and body, in a 250X photomicrograph



Breather assembly for a fuel-injection pump consists of a stamping and a screw-machine part. Extruded hole in stamping gives good contact with body

Magneto coupling plate consists of a stamping, copper ring, and screw-machine part. Surface finishes on both parts are adequate so no machining is required on the assembly

shells are either pack carburized or gas carburized, then hardened and drawn to the equivalent of 58-63 Rockwell C, and finish ground.

The photomicrograph shows the copper-brazed bond between the disk and the body, the joint running vertically through the center of the field. The light constituent in the bond is copper which has undoubtedly dissolved a small amount of iron and had its strength materially increased thereby. A penetration of copper along the grain boundaries of the steel, and an alloying of copper into the surfaces of the steel are both distinguishable by the darkened areas. Precipitation of the iron-rich phase from the copper upon cooling is indicated by dark globules within the joint which have knitted themselves together. All of these various effects contribute to the high strength found in the copper-brazed bonds.

Another interesting phenomenon which sometimes occurs in the copper brazing of steel assemblies where good metal-to-metal contact is maintained throughout the process, is that the steel grains actually unite and grow across the joint. This condition, illustrated to some extent in the photomicrograph, materially adds to the strength of the assembly.

In one test a low-carbon-steel unit was put through the copper-brazing cycle without copper. To press the two members apart required a force eight times that required initially to assemble them.

Formerly Machined From Bar Stock

Typical of numerous parts formerly machined in one piece from bar stock, but now furnace-brazed, is the breather assembly for a fuel-injection pump. The part was originally made from 1¾-in. dia. bar to produce the wide flange and was cut down to the size of the threaded and sleeve portions.

Now the flange is made from cold-rolled strip steel in punch presses, and the body is turned out on automatic screw machines. As a result, over-all costs have been reduced 70%.

In the original method the 1¾-in. blank weighed about one pound but the finished part weighed only 1½ oz. 84% of the material was wasted in scrap. Blanks for the present stamping and screw-machine part, on the other hand, weigh only about ½ lb. This means that the material costs alone have been reduced 50% in the conversion to electric-furnace brazing. This also means that more parts are turned out in a given amount of time.

The flange has an extruded center hole to provide a sleeve joint over the body. This provides a large area of copper-brazed bond for maximum strength and tightness and assures a good sleeve fit instead of the line contact that would result if the hole were simply punched.

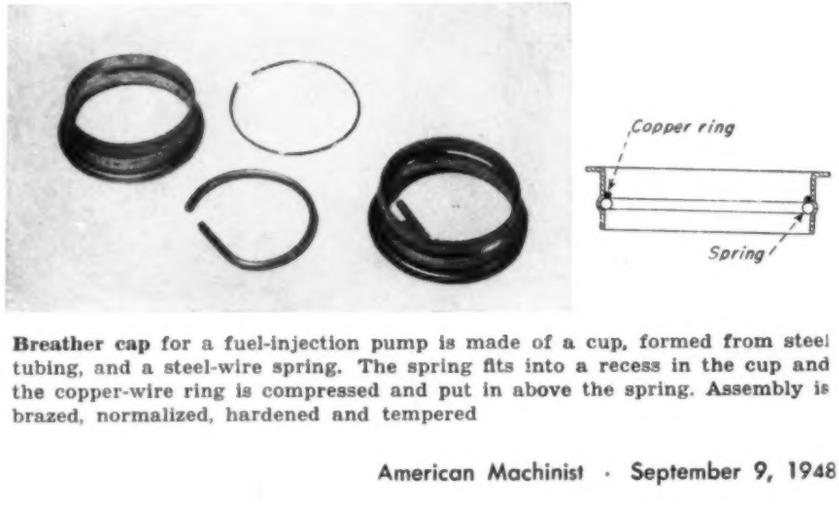
A shoulder is turned on the body to serve as a stop and reinforcement for the flange. This is good practice for locating the flange during assembly, and also for holding it in place during furnace brazing. Sometimes when parts become heated and expanded, they slide on one another because of force of gravity, and precautions such as this are desirable to prevent movement.

The flange and body are made for a press fit of 0.001 to 0.003 in. and are assembled on kick presses. Then rings of hard copper wire formed to slightly smaller diameter than the body are pressed over the body above the extruded portion of the flange. Assemblies are brazed in trays at the rate of 630 per hr., all handled by one operator.

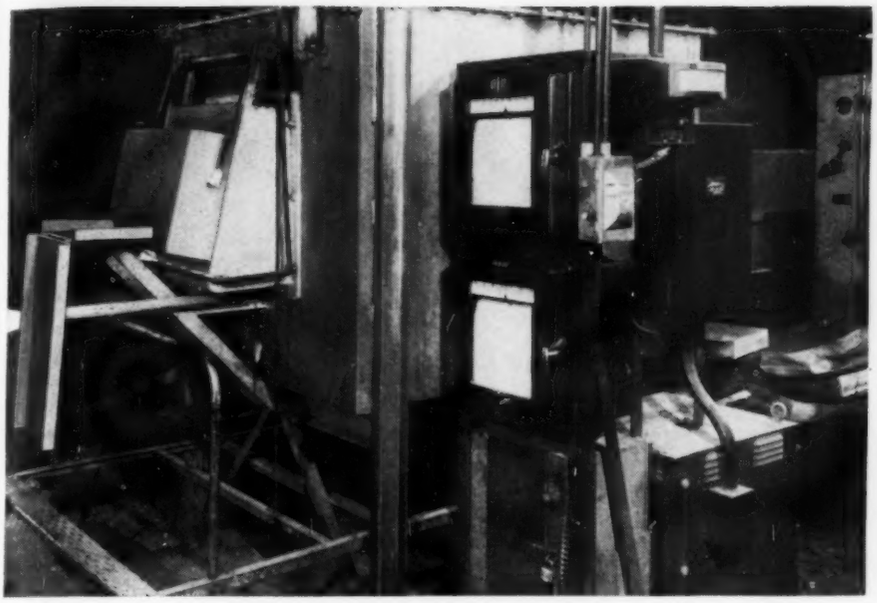
Previously Torch Brazed

In some cases, changing from other fabricating methods to electric-furnace brazing permits replacing skilled manual operations with non-skilled, semi-automatic operation. Fluxing before brazing to assure wetting by and flowing of the brazing metal, and removal of flux deposits after brazing for the sake of appearance and avoidance of corrosion, are generally eliminated.

A typical example of conversion from torch brazing is the fuel-oil filter can for diesel engines. Design of the assembly, which is about



Breather cap for a fuel-injection pump is made of a cup, formed from steel tubing, and a steel-wire spring. The spring fits into a recess in the cup and the copper-wire ring is compressed and put in above the spring. Assembly is brazed, normalized, hardened and tempered



Electric furnace has foot-operated outer door to ease hand loading. At center and right are the temperature-control instrument (one is for another furnace), temperature-limit instrument, power-control panel, power transformer, and atmosphere gas converter (background)

4¼ in. in dia. by 3⅛ in. high, is essentially the same for both methods. Assembly and brazing is done in the regular fashion. Since the units come from the furnace clean and dry, they are cadmium plated without any intermediate cleaning operations other than those normally required for such plating.

Formerly Cast

Parts made from castings also can be redesigned for furnace brazing to employ screw-machine parts, stampings, and pieces of tubing, with savings in material and machining time similar to those already described. In addition, quality is sometimes improved through strengthening members at critical joints or by eliminating porosity. An example of the latter type is the leak-off valve shown.

Porosity of the original casting caused leakage and to overcome this, the valve was converted to a furnace-brazed assembly. This compares favorably with the casting with respect to weight, strength and cost, and more important the valves are now uniformly tight.

The assembly is made of two B-1113 screw-machine parts, pressed together with a light interference fit, and with a copper-wire ring preplaced around the joint. Parts are threaded and drilled part way through on the screw machines, but drilling of the connecting holes is done after the assembly is furnace brazed.

In setting the parts up on the trays, preparatory to furnace-brazing, the insert is placed in the upright position, as shown in the sectional view with the copper-wire ring on the top side, so that gravity will aid the flow of copper toward and into the joint. Once started, capillary attraction will draw the brazing metal through, so long as there is a supply available.

In many cases it is necessary to place the brazing metal at the bottom of a joint and expect it to creep upward by capillary attraction. This can be depended upon so long as there is a snug fit all the way to provide good capillary attraction. It is generally preferable, however, to locate the brazing metal on top and work with gravity rather than in opposition to it.

Initially Designed for Furnace Brazing

Having furnace-brazing facilities makes it possible to design new units as assemblies of inexpensive components that can be made at a fraction of the cost of forgings, castings, or machined parts. A typical example is the magneto coupling plate illustrated previously.

Another assembly designed for furnace brazing and difficult to make any other way is the breather-cap for a fuel-injection pump.

Brazing-Furnace Equipment

Typical of the three complete sets of brazing-furnace equipment in the American Bosch plant is the one illustrated. The heating chamber has capacity for one tray and the cooling chamber has capacity for three. Ribbon-type rolled-alloy heating units are mounted on the side walls radiating heat directly to the trayload of work which rests on a hearth of cast-alloy rails. A normally-closed refractory door between the heating and cooling chambers keeps the heat in to provide minimum thermal losses and maximum working length. Tight-fitting end doors keep the gas atmosphere within the heating and cooling chambers and gas-flame curtains play up across the openings when the doors are raised. This is a flexible furnace in that it is useful not only for furnace brazing, but also for bright annealing, normalizing, hardening and sintering. Also it is economical and practical for brazing either light-, medium-, or heavy-weight parts.

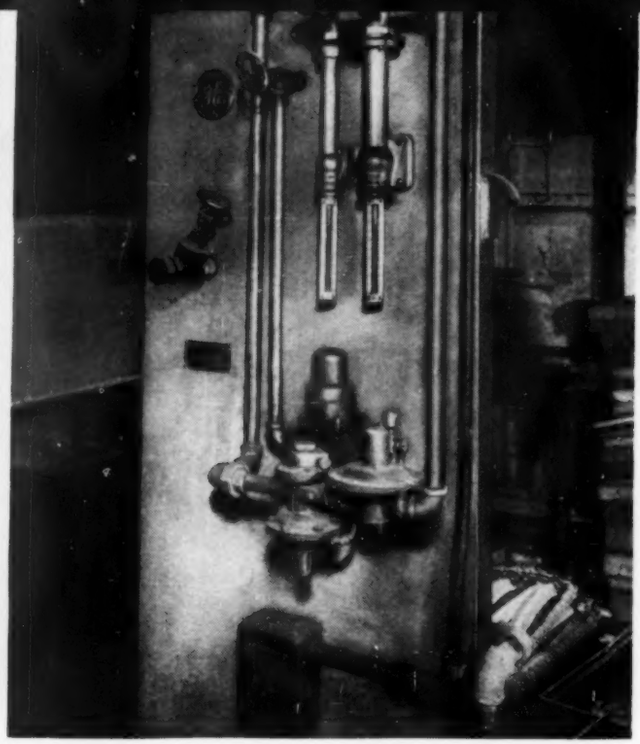
A trayload of small parts is pushed into the 2025-2050 F. heating chamber. After the tray is started in by hand, it is moved the rest of the way with a steel pusher rod. The furnace door opening is 12 x 8 in., the heating-chamber length is 38 in., and the cooling chamber length 100 in. The electrical rating is 29 kw.

The atmosphere gas converter. pictured, partially burns coke-oven gas, making a reducing atmosphere which is very suitable for the furnace-brazing work, and at the same time one which is quite inexpensive. Analysis of the gas is about 17% hydrogen, 10% carbon monoxide, 5% carbon dioxide, 1.5% methane, 66.5% nitrogen, with dewpoint of about 70 F. Rating of the unit is 200 cu. ft. per hr. output.

Conclusion

The American Bosch Corporation was well launched on its furnace-

Trayload of small assemblies is started into the furnace by hand and pushed to final position with a steel rod



Atmosphere gas converter reforms coke-oven gas by partial combustion, supplying an inexpensive atmosphere

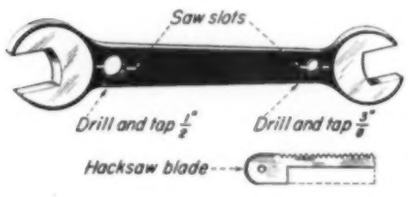
brazing work before the United States entered World War II. During the war, the process proved to be a real production expediter, helping the war effort by speeding up production and releasing vital facilities and manpower which were so important at that time. Now, in its peace-time production, this company and users of its products continue to reap the same benefits in the form of improved quality, simplified fast production, and low costs.

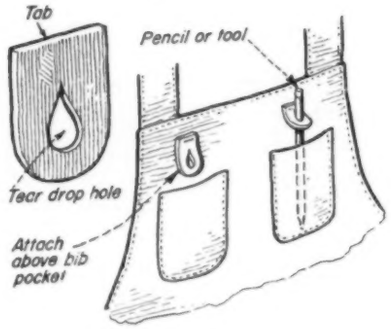
(Note: The author gratefully acknowledges invaluable assistance from Howard E. Boyer, Chief Metallurgist, American Bosch Corporation, Springfield, Mass.)

Short Cuts FOR THE SMALL SHOP

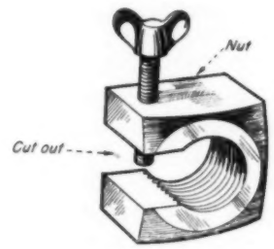
BY A. H. WAYCHOFF

DAMAGED THREADS on screws can be straightened with tapped holes in the body of openend or engineer's wrenches. After drilling and tapping the holes (the screw sizes to correspond with nut sizes of the wrench openings) cut saw slots into the tapped threads. These slots will serve as flutes, so that the threads will cut like solid dies. To saw the slots, take a piece of old hacksaw blade and grind down as shown. The modified wrench will help while working on battered studs, etc.

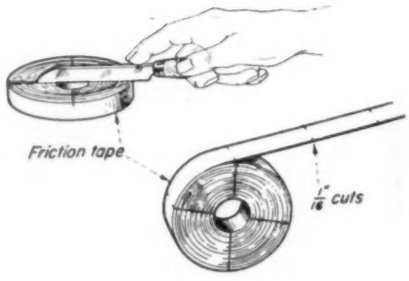




TO PREVENT LOSS of pencil, marking crayon, a scratch-all or other instrument likely to be carried in bib pockets, make a little rubber tab as follows: Cut a 1-in. square from old auto inner tube. Then pierce a teardrop hole of a size that will grip the article. Fasten the tab to the bib above the pocket with a rivet, paper staple or similar means. The tab will not get in the way and it will keep your small articles safe until needed.



SMALL C-CLAMPS for very small work may be made from square nuts of suitable size. Cut out one side of the nut, and drill and tap a hole for a thumbscrew.



FRICTION TAPE will tear better if "nicks" are cut with a sharp knife. Shallow cuts will not affect the tape in any way, but will avoid the annoyance of ravelings.

Strip charts showing surface conditions on sample often are very helpful in studying production processes for improvement of part quality

How Smooth is Smooth?...PART I

SPECIFICATION AND EVALUATION OF MACHINED FINISHES

"When you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge but you have scarcely, in your thoughts, advanced to the stage of science, *whatever the matter may be."* —LORD KELVIN, MAY 3, 1883

BY BEN C. BROSHEER, ASSOCIATE EDITOR

NEED for control of surface quality has grown importantly with modern design and manufacturing methods. But until recently, it has not been possible for the engineer to write good specifications for surface finish nor the shop to work to definite standards. Now the means are available both to specify and measure surface roughness in terms of a single numerical value. Furthermore, because of the vast amount of work done on surface-quality mensuration since 1929, we know quite a lot about the measurable dimensions of a surface's topography and how they may be related in some measure to the needs of a specific application. Here, then, is a summary of present-day knowledge on surface finish, drawn from many published sources and from discussions with leading investigators and companies. Later, a supplementary Special Report will complete the discussion of existing equipment and reference standards to measure surface finish.

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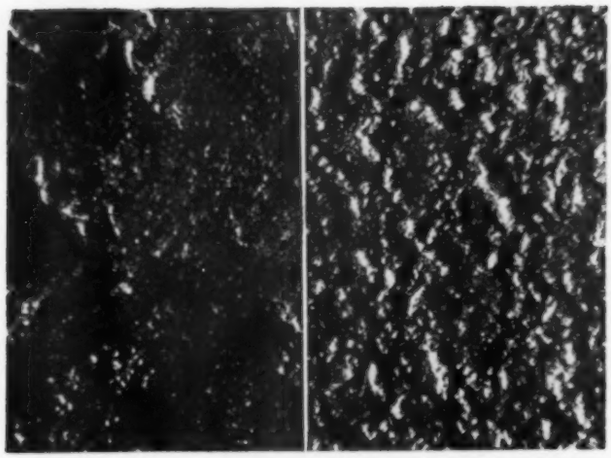
HOW SURFACE MEASUREMENT HAS EVOLVED



Enlargement of photomicrograph taken with Comparoscope. Left—Surface of auto body steel sheet "as rolled." Right—Pickled body sheet

THERE IS more to a machined surface than meets the eye. For as Swigert (21) has pointed out: surface quality is a *condition*, not a dimension. Actually, a machined surface is an exceedingly complex affair. It departs from a perfectly smooth, ideal surface even when finished with tools having extremely smooth cutting edges or with the finest of abrasive wheels. So what seems to be a smooth surface actually has several hundred thousand tiny irregularities per square inch.

Why is surface finish important? Shop practice has come a long way since interchangeable manufacturing was first introduced. Ever since that day, finish standards have become increasingly important to realize the engineer's objectives. No longer can we get along with the standards of yesteryear, when only three grades of finish were listed in shop nomenclature: a good finish, a damn good finish and a - - - - damn good finish.

Today we have an American Standard for surface roughness, engineering societies and the services have standards on the subject, manufacturing concerns control the surface roughness of selected parts. The outlook: a system that can be used with even better results right in the shop to control machine setups and produce parts to stated surface finish standards.

What brought about the recent development of surface finish standards? Answer: the difficulty of getting people in various shops to work to the same degree of finish. People within one organization may understand what is meant by finish symbols like "*f*", "*ff*", "f_s", but only confusion arises when parts are made in separate establishments to the same set of drawings. Besides these purely definitive specifications are not sufficiently exact for many present-day engineering requirements.

Fortunately, the evolution of surface-finish mensuration rests on a firm foundation of 20 year's development work by a number of investigators (See bibliography). In their investigations of the properties of surfaces, these men devised a number of instrument and comparison devices. Some evaluate surfaces in *qualitative* terms: others give *quantitative* readings. Thus, the means are now at hand to fulfill Mikelson's (111) observation of the need for a convenient method by which: (1) the engineer can select and specify the degree of allowable roughness, (2) the machine operator can compare his work with a specification, and (3) the inspector can check the finished product against that specification—all in terms understandable throughout the metalworking industry.

This report is concerned with methods for evaluating surfaces produced by turning, boring, planing, milling, shaping, broaching, grinding, honing, lapping, Superfinishing, burnishing and polishing.

Evaluation of Surface Topography

EACH type of cutting tool or machining operation leaves its own individual markings (47). Shape of the cutting edge, its smoothness, type of tool, and its method of use all affect the smoothness and character of the finish produced. Ernst and Merchant (27) have reported that almost all of the *roughness* on a machined surface consists of tiny fragments of metal which have been left behind by a built-up edge on the nose of the cutting tool. Prevention of the built-up edge therefore should result in finer finishes and more consistent surfaces.

Broadston (47) reminds us that cutting conditions

Both visual and touch or fingernail comparisons of surfaces can be made in design offices, at inspection benches and at production machines when sets of standard specimen blocks are employed

vary with the material. In brittle materials, such as cast iron, chilled castings and hard bronze, individual crystals torn away during the cutting operation may leave blunt, rough cavities which follow the crystal boundaries. In some cases, clam-shaped cavities appear. When ductile materials, like copper, aluminum or mild steel, are cut at low speeds, even-spaced, wedge-shaped crevices which widen towards the outer surface, often appear. These crevices or gaps disappear when the cutting speed is increased.

The state of a surface is described by Finch (70) in terms of texture and structure. Texture comprises geographical, or topographical, features such as ridges and valleys, pits and peaks, crystal outlines, etc., while structure is determined by the nature and arrangement of the atoms beneath the surface.

Finch (70) found that the direction of sliding in relation to that of scratches left by the finishing process has an important bearing on the running-in of a surface. If scratches lie at right angles to the sliding motion, wear is at a minimum.

Irregularities in surface texture are deviations from the geometrically ideal form. Way (26) terms lack of trueness as those deviations which can be checked with conventional measuring instruments; as roughness, those errors measurable only with devices that check deviations within areas small compared to the average caliper face. Abbott (18) studied the irregularities found on hundreds of profile records of a wide variety of surfaces and concluded that: irregularities with spacings less than 1/32 in. are roughness; irregularities with spacings greater than 1/32 in. constitute waviness. The limits of the measurement band of the Profilometer were based on these studies.

Surface-roughness measurements are made in microinches in the United States and Great Britain; in Europe, measurements usually are in microns.

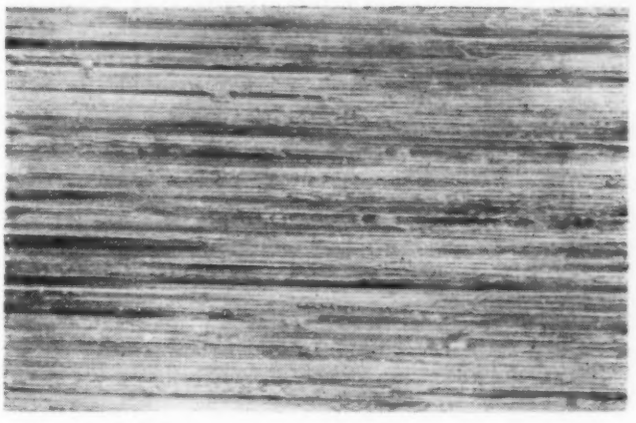
The *microinch* is one-millionth part of the U. S. Standard linear inch; usually is abbreviated as "mu. in."; sometimes as "mi. in." The micron is one-thousandth of a millimeter; one micron equals 39.4 microinches.

Methods of describing and evaluating surfaces have been grouped by Way (26) into four classes: (1) qualitative, (2) single parameter, (3) multi-parameter, and (4) graphical descriptions.

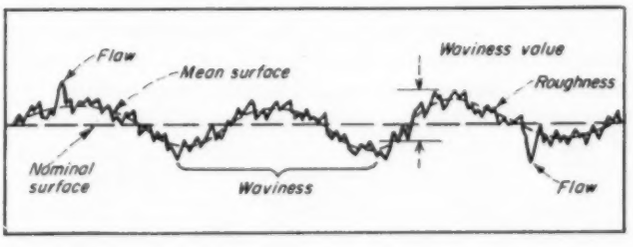
Qualitative methods include: visual and touch comparisons of the surface with a sample part or a standard-finish specimen block; also the standard microscope, special surface-comparison microscopes, photomicrographic reproductions, and translucent surface replicas. Accuracy of such methods of surface evaluation depends on experience and opinion of the inspector, but surfaces of practically any size, shape or material can be checked. The difference in surface quality recognizable by a competent inspector is fairly good.

Schlesinger (35) cautions against judging the quality of a surface by its ability to reflect light. Often a dull surface (especially when made by lapping) has a larger bearing area than a bright.

Typical fragmented surface as produced by most cutting operations with single-point tools. Faxfilm replica of shaper cut on steel, 100X

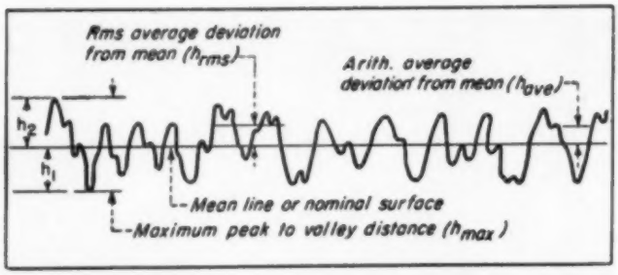


Even smoothly ground steel surfaces have many irregularities, as shown by this 100X enlargement of a Faxfilm replica

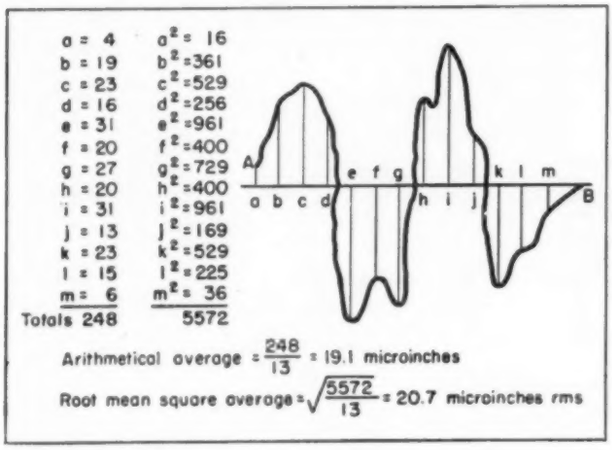


This enlarged surface profile illustrates differences between macro and micro deviations from geometrically true surface. Waviness (lack of trueness) is measurable in decimal inches with conventional gages, such as precision dial indicators. Roughness can be measured only by more accurate methods, and is in terms of millionths of an inch

Quantitative single-parameter descriptions of machined surfaces are usually preferred over qualitative descriptions, except for spot checking of mass-produced parts. But the single-parameter value should be accompanied by a statement of the type of finishing process used, and be chosen only after consideration of the use for the part. A two-parameter description is preferable to a single-


Rms average deviation from mean (h_{rms})
Arith. average deviation from mean (h_{ave})
h_2
h_1
Mean line or nominal surface
Maximum peak to valley distance (h_{max})

Single-parameter quantitative descriptions of a surface can be calculated from a profile curve developed by tracing the surface with an instrument connected to a recording tape, or by such methods as taper sectioning


a = 4 a^2 = 16
b = 19 b^2 = 361
c = 23 c^2 = 529
d = 16 d^2 = 256
e = 31 e^2 = 961
f = 20 f^2 = 400
g = 27 g^2 = 729
h = 20 h^2 = 400
i = 31 i^2 = 961
j = 13 j^2 = 169
k = 23 k^2 = 529
l = 15 l^2 = 225
m = 6 m^2 = 36
Totals 248 5572
A
B
a b c d e f g h i j k l m
Arithmetical average = $\frac{248}{13}$ = 19.1 microinches
Root mean square average = $\sqrt{\frac{5572}{13}}$ = 20.7 microinches rms

Calculation of arithmetical average and root-mean-square average deviations for profile charts is not difficult, but is tedious. Direct-reading tracer type instruments are preferable if many surface must be checked

parameter description, and in that case Way (26) recommends that one be a "magnitude" factor and the other a "form" factor.

When measuring roughness on a surface having a "regular" form, such as a plane, a cylinder or a cone, a quantitative description using an average height dimension can be obtained in a number of ways from a profile curve (see sketch) of a portion of the surface. Any one of the following quantities can be considered a measure of roughness: the maximum peak-to-valley height (h_{max}); the average peak-to-valley height based on lines drawn parallel to the *mean* line through peaks and valleys estimated to be of average height and depth; arithmetical average deviation from the mean surface (h_{ave}); root-mean-square average deviation from the mean surface (h_{rms}); average height of profile (h_1), average depth of hollows (h_2), or one of several proposed form factors. The first four of the parameters listed are those specified in American Standard B46.1-1947.

The above single parameters which measure the height of irregularities of the profile can be scaled from the enlarged profile, or calculated (h_{ave}) and (h_{rms}) as shown in the accompanying table. But the average-deviation parameters are more easily and accurately obtained from direct readings of such tracer-type instruments as the Profilometer, the Brush Surface Analyzer (with RMS meter), the Talysurf, the Topograph, or the Proficorder.

Reason (72) states that the imperfect surface can generally be discussed satisfactorily in two cross-sections taken at right-angles. Dayton, Nelson and Milligan (38), when studying seizure resistance of journal bearings, found that good correlation existed between relative seizure resistance and typical one-direction h_{rms} meter readings, so long as all surfaces were finished by one type of operation. When comparing different types of surfaces, better correlation was found between seizure loads and the product of h_{rms} readings in axial and circumferential directions.

Parameters h_{ave} and h_{rms} are closely related and usually do not differ more than the usual allowable percentage of error in stylus-type tracer instruments. Normally these values are ¼ to 1/5 of h_{max}, but for the finer finishes this ratio may be as much as 1/10. The maximum depth of roughness, h_{max} is useful principally because of its simplicity of concept.

Because so many factors influence the value of a finished surface, a number of other parameters, including the form, slope or wavelength of the roughness profile curve have been suggested from time to time. Schmaltz suggested that the ratio of the average height of profile to the maximum peak-to-valley height (h_1/h_{max}) be used. Nicolau (17) suggested the substitution of the value h_2 for h_1 in the Schmaltz formula. Walker (11) recommended using the percentage of bearing contact area to total area as a measure of surface quality. This is provided for in the Navy's Bureau of Ships Standard NAVORD OSTD 4 and in several other standards.

Often surface waviness is as important as roughness to successful use of a particular finish. Its measurement therefore is provided for in American Standard B46.1-1947.

Graphical description of the shape of a surface sometimes helps to evaluate its effectiveness. The description might consist of a profile map, a contour map, or a bearing-area curve as suggested by Abbott and Firestone (8). See sketch. This curve shows the relation between the fraction of the length of a line that passes through the material and the depth of this line below the highest peak of the surface. It generalizes the irregularity of the profile curve.

Dimensional Accuracy and Finish Quality

QUALITY of surface finish is tied closely to dimensional and geometrical accuracy. The following table has been suggested as a reasonable mark from which to initiate studies of such a relationship:

DIMENSIONAL TOLERANCES	SURFACE ROUGHNESS (h_{rms})
Below ± 0.0002 in.	Below 5 microinches
± 0.0002 to ± 0.0005 in.	5 to 10 "
± 0.0005 to ± 0.0020 in.	10 to 30 "
± 0.0020 to ± 0.0050 in.	20 to 60 "
± 0.0050 to ± 0.0100 in.	40 to 100 "
Above ± 0.010 in.	No Relation

Bearing-area curve (right) **suggested by Abbott and Firestone (8) is developed from profile curve (left) as an effective way to describe a surface graphically**

Standard Specifications for Surface Quality

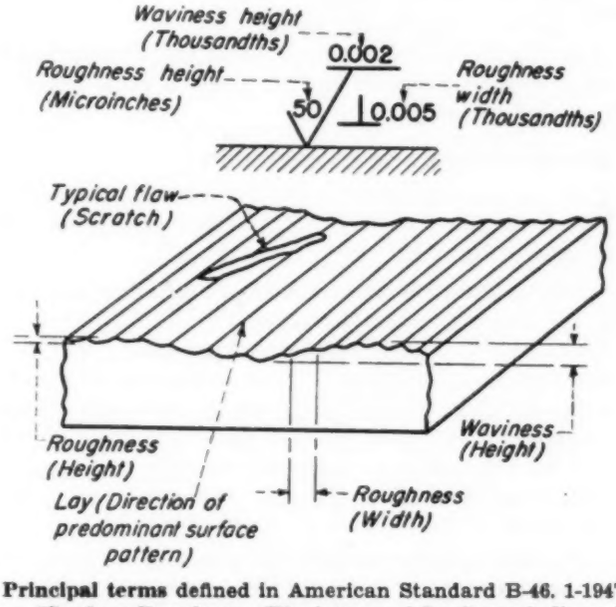
PART I of American Standard B46.1-1947 "Surface Roughness, Waviness and Lay" provides a set of symbols for use on drawings and in specifications. Ranges for roughness and waviness are divided into steps; general types of lay are established by type characteristics. Only the height, width and direction of surface irregularities are considered.

Finishes suitable for specific applications are not covered, nor are the means for producing them. Neither does the standard define the means, procedure or apparatus for measurement of the roughness and waviness of the surface. These are matters for individual plants and design engineers to decide, and are not subjects for standardization.

Prior to American Standard B-46.1-1947, a number of standardizing groups and individual companies set up their own standards for surface finish control and specification. Most of these standards parallel the new American Standard.

Most important of these standards are:

1. The "Aeronautical Standard on Surface Finish" (No. AS-107A) issued by the Society of Automotive Engineers principally for control of finishes on aircraft engine parts.



Principal terms defined in American Standard B-46. 1-1947 on "Surface Roughness, Waviness and Lay" are indicated in lower sketch. Above it is the standard symbol for indicating roughness, waviness and lay requirements on drawings

2. The "National Aircraft Standard on Surface Roughness Designation" (No. NAS-30) issued by the National Aircraft Standards Committee for control of machined surfaces on airframe parts.

3. The addition of a new section on "Surface Roughness—Designation and Measurements" to Ordnance Standard No. NAVORD OSTD 4 by the Navy Department's Bureau of Ordnance.

4. The preparation of Ordnance Standard No. URAX6 by the Army Ordnance Department to interpret previously established surface-finish code symbols for drawings in terms of microinch rms roughness values as well as to supersede those symbols as new drawings are prepared.

The first three of the above standards are basically the same as the new American Standard. There is this one essential difference: roughness values in the American Standard can be stated in any one of four specified terms, while the first three of the above standards specify that roughness shall be measured in terms of average root-mean-square deviation from the mean surface.

Approved Surface Roughness Nomenclature

DEFINITIONS shown in *italics* in the following list are from American Standard B46.1-1947; explanatory notes are from other standards.

SURFACE. *The surface of an object is the boundary which separates that object from another substance. Its shape and extent are usually defined by a drawing or descriptive specification.*

NOMINAL SURFACE. This terms sometimes is used to specify a geometrically perfect two-dimensional boundary of separation whose shape and extent is defined by specificaton or drawing dimensions, and is the surface that would result if the peaks were leveled off to fill the valleys.

SURFACE QUALITIES. The physical characteristics of a surface may be described as roughness, waviness, size and shape of flaws, and lay. The surface profile, microstructure, bearing area, and luster may also be referred to.

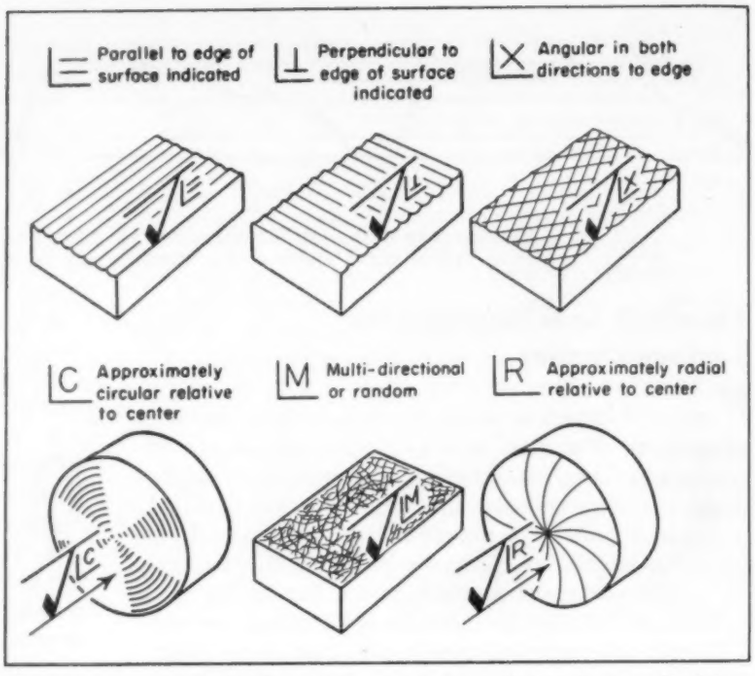
PROFILE. *The contour of any specified section through a surface.*

ROUGHNESS. *Relatively finely spaced surface irregularities. On surfaces produced by machining and abrading operations the irregularities produced by the cutting action of tool edges and abrasive*

Symbols Indicating Direction of Lay

=	Parallel to the boundary line of the surface indicated by the symbol.
⊥	Perpendicular to the boundary line of the surface indicated by the symbol.
X	Angular in both directions to the boundary line of the surface indicated by the symbol.
M	Multi-directional.
C	Approximately circular relative to the center of the surface indicated by the symbol.
R	Approximately radial relative to the center of the surface indicated by the symbol.
= .005	The numerical value in inches of the width of spacing of roughness is added to the right of the directional indication of the lay symbol as shown.

Symbols for indication "Lay" of surface in drawing symbols given above are those recommended in American Standard B46.1-1947 on Surface Roughness, Waviness and Lay


Parallel to edge of surface indicated
Perpendicular to edge of surface indicated
Angular in both directions to edge
C Approximately circular relative to center
M Multi-directional or random
R Approximately radial relative to center

Some company standards call for the lay symbol to be inscribed in a half square, as indicated above. Sketches with each symbol make it easy to visualize meaning

grains, and by the feed of the machine tool are roughness. Roughness may be considered as being superimposed on a "wavy" surface. Roughness itself is not considered to affect the trueness of a surface as shown by a dimensional checking gage. Usually, roughness deviations are measured perpendicular to the nominal surface.

WAVINESS. *The surface irregularities which are of greater spacing than the roughness. On machined surfaces such irregularities may result from machine or work deflections, vibrations, etc. Irregularities of similar geometry may occur due to warping, strains, or other causes.*

FLAWS. *Irregularities which occur at one place, or at relatively infrequent intervals in the surface, e.g., a scratch, ridge, hole, peak, crack, or check.*

LAY. *The direction of the predominant surface pattern.* Normally determined by the production method used. A turned or ground surface has a definite direction of lay, whereas a lapped surface has not, and is therefore considered multi-directional.

ROUGHNESS WIDTH RATING. *The maximum permissible width of repetitive units of the dominant surface pattern. It may be specified in inches adjacent to the lay symbol. Irregularities having widths up to and including the maximum specified, or when no dimension is specified, up to and including the width of the irregularities due to machine feed shall be the basis for the roughness height specification.*

WAVINESS WIDTH RATING. *Waviness widths may be specified directly in inches.*

HEIGHT RATING. *The height of the roughness or waviness shall be specified in one of the following terms:*

Maximum Peak to Valley Height (h_{max})
Average Peak to Valley Height
Average Arithmetical Deviation From Mean Surface (h_{ave})
Average Root-Mean-Square Deviation from Mean Surface (h_{rms})

Note: A general note should be included in all specifications and drawings indicating which type of height rating is intended.

LAY SPECIFICATION. *The lay of a surface shall be specified by the lay symbol indicating direction of the visible surface marks.* Some specifications call for the lay symbol to be inscribed in a half square (see sketch above).

Measurement or Evaluation

FOR compliance with specified ratings, American Standard B46.1-1947 states that surfaces may be evaluated by:

(a) Comparison with specified reference surfaces or observational standards.
(b) Direct instrument measurements.

In many applications, these comparisons can be made by sight, feel or instrument. In making comparisons, care should be exercised to avoid errors due to differences in material, contour, and type of operation represented by the reference surface and the work.

In using instruments for comparison, or for direct measurement, care should be exercised to insure that the specified quality or characteristic of the surface is measured.

Roughness measurements, unless otherwise speci-

fied, are taken across the lay of the surface, or in the direction which gives the maximum value of the readings on the instruments.

Recommended Value for Roughness and Waviness

AMERICAN STANDARD B46.1-1947 tabulates the following recommended numbers for roughness and waviness. The use of one number to specify height or width of irregularities indicates the maximum allowable value. Any lesser degree will be satisfactory. When two numbers are used, they specify the maximum and minimum permissible values.

ROUGHNESS HEIGHT VALUES (MICROINCHES)

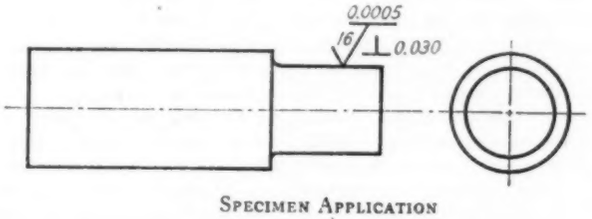
¼	5	20	80	320
½	6	25	100	400
1	8	32	125	500
2	10	40	160	600
3	13	50	200	800
4	16	63	250	1000

WAVINESS HEIGHT VALUES (INCHES)

0.00002	0.00008	0.0003	0.001	0.005	0.015
0.00003	0.0001	0.0005	0.002	0.008	0.020
0.00005	0.0002	0.0008	0.003	0.010	....

Aeronautical Standard No. AS-107A issued by S.A.E. lists 25 recommended numbers for indicating allowable roughness in microinches rms. They are as follows: **1**, 2, **3**, 4, **5**, 6, **8**, 10, **13**, 16, **20**, 25, **32**, 40, **50**, 60, **80**, 100, **130**, 160, **200**, 250, **320**, 400, and **500**. Preferred numbers are in bold face.

Preferred numbers for indicating allowable waviness in inches are: 0.00002, 0.00005, 0.0001, 0.0002, 0.0005, 0.001, 0.002, 0.005, and 0.010 in. To control contact area when required, the above scale may be supplemented with a percentage bluing note (90% - 75% - 50% preferred); thus, 0.00005 - 90% blue indicates that deviation shall be 0.00005 in. or less and that the surface shall show 90% contact with a mating bluing gage.



SPECIMEN APPLICATION

Roughness height = 16 microinches
Waviness height = 0.0005 in.
Lay = Circumferential
Roughness width = 0.030 in.

American Standard B46.1-1947 specifies the above symbol for designating surface roughness, waviness and lay on drawings. It consists of a check mark and horizontal extension. Point touches the lines indicating surface to which specification applies, or an arrow pointing to the surface

National Aircraft Standard No. NAS-30 lists nine numbers in a preferred series to indicate microinches rms maximum allowable roughness: **1, 2, 5, 10, 20, 40, 100, 250, 500.** No preferred values are given for waviness height.

Ordnance Standard NAVORD OSTD 4, prepared by the Navy Department, lists 14 preferred roughness height values in microinches rms maximum allowable: ¼, ½, 1, 2, 4, 8, 16, 32, 63, 125, 250, 500, 1000, and 2000. The finer ¼ and ½ values are rarely used, except for special gages. This standard also lists seven preferred values for specifying maximum allowable waviness in inches: 0.00005, 0.0001, 0.0002, 0.002, 0.005, 0.010, 0.020 in. The standard states that waviness shall be specified by a note giving the maximum waviness in decimals of an inch, selected from the table, and the percentage of contact area, such as 90%, 75% and 50%. Unless otherwise specified, the contact area must be uniformly distributed over the surface.

Standard Symbol for Surface Quality

THE symbol specified by American Standard B46.1-1947 to designate allowable surface irregularities is the check mark and an horizontal extension as shown in the accompanying sketch. Point of the symbol may be on the line indicating the surface, on the witness line, or on an arrow pointing to the surface. The long leg and extension preferably are to the right, as the drawing is read.

Roughness height value is placed adjacent to and on the inside of the long leg. Waviness height value, when required, is placed above the horizontal extension line, and the lay designation, when required, is indicated by the lay symbol placed under the extension to the right of the long leg. Roughness width value, when required, is placed to the right of the lay symbol. The symbol shown is virtually the same as that called for by most other surface finish standards.

Individual Company Standards

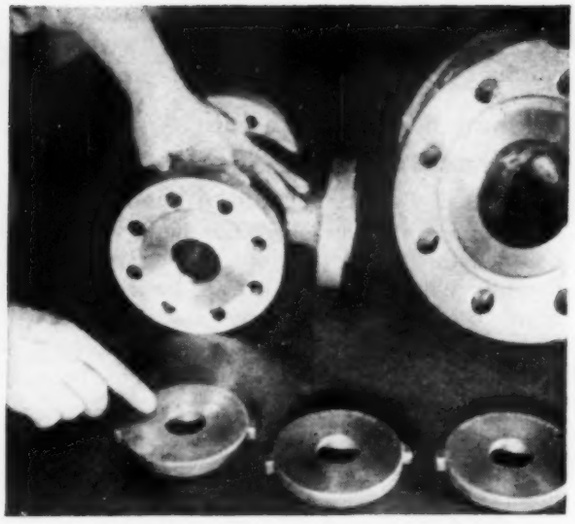
MANY of the companies who have contributed data for this report had adopted surface quality control standards prior to the approval of B46.1-1947. For the most part, these company standards have been based on society or service standards.

Other companies followed the lead of the Army Ordnance Department, and assigned microinch rms ratings to their "*f*" system codes.

What Finish to Use?

SELECTION of the proper degree of surface smoothness must be the responsibility of the design engineer. He, alone, knows the function of the part and of its surfaces, and the conditions under which it will operate. Effects of surface finish on performance must be evaluated carefully if the best finish for the job is to be specified. And the best finish, for many parts, is not always the smoothest. The sometimes practiced plan of working toward the

Most metalworking plants still make quality decisions by visual inspection or feel, except on very critical surfaces. Standard sample of each size of part, with roughest acceptable finish, is kept in inspector's cabinet. Standard specimen blocks are used when inspecting parts for which samples have not been made



Standard roughness disks used by Crane Co. have central hole for storing on wood pins. Five disks in set: standard machine finish, fine tool finish, smooth tool finish, ground finish and lapped finish

perfectly smooth surface as an ideal often is not economic. Nor is it insurance that the finished part will perform to best advantage.

The designer should keep in mind the fact that geometrical errors and misalignment of the members of an assembly frequently are more important than surface quality, particularly in large machines.

We still know very little about the relation of surface roughness, or smoothness, to performance, or about the other variables which also affect performance. Measuring devices which evaluate surface qualities must, therefore, be used extensively in the laboratory as well as out in the shop to study effects of varying the characteristics of surfaces. Finch (70), Wulff (24), and others have shown that the operations performed on a surface prior to the final finishing operation can have a more profound and permanent effect upon wear than the final finish. Eventually, the production or tool engineer responsible for planning production operation sequences, and the design engineer responsible for specifying surface quality, may find it desirable to work together closely when setting up to manufacture, for example, motor shafts with heavily loaded journals.

Many metal products do not require close control of machined surface quality, others must be checked at frequent intervals to insure maintenance of correct manufacturing techniques. This is especially true where close dimensional tolerances are specified, and where bearing loads are high. Practice varies widely between different plants, even within the same or similar industries.

One automobile manufacturer, for example, reports that only eleven parts made in his plant have surfaces whose finishes are specified in microinches rms. These range from 16 mu. in. rms for the thrust faces and bearing journals on the crankshaft, to 125 mu. in. rms. for braking surface in brake drums. Another maintains surface quality control on only four parts, making spot checks at frequent intervals to hold the required surface qualities.

A third producer of motor cars reports that finished surfaces on parts made in his plant can be grouped in eight classes with average roughness values of 3, 4, 5, 7, 10, 16, 24 and 48 mu. in rms. Since finishes may be expected to vary 25-30% above and below the average, ranges of 2-4, 3-6, 5-9, 8-12, 12-20, 18-30 and 25-100 mu. in. rms are assigned.

The following general recommendations for applications of the various grades of surface quality is prepared as a guide for proper surface selection:

1 Mu. In. RMS: Produced by precision lapping, rouge lapping, cloth wheel and tripoli polishing, hand lapping, and similar processes. Very expensive unless done with modern precision finishing machines. Used for anvils on micrometers, high grade gages, etc.

2 Mu. In. RMS: Produced by precision lapping and similar processes. Used for gages, refrigerator seals.

3-7 Mu. In. RMS: Produced by same processes as above. Used where packings and rings must slide across the direction of the surface grain, as in interior honed surfaces of hydraulic struts and on buffed chrome-plated piston rods. Also used on rolls for roller bearings subject to heavy loads, such as slide trunnion bearings.

7-13 Mu. In. RMS: Produced by precision lapping, fine cylindrical grinding, buffing and similar processes. Expensive unless done with precision machines. Used only when coarser finishes are proved to be inadequate. Applications include runners for Kingsbury-type thrust bearings, hydraulic cylinders, pistons and piston rods for "O" ring packings, journals operating in plain bearings, rolls for roller bearings, surface on shaft for grease seals, etc.

14-25 Mu. In. RMS: Produced by fine grinding, honing, smooth reaming and similar processes. Surfaces for high-speed shaft journals, heavily loaded bearings, rolls for commercial-grade roller bearings, bores and outer diameters of such bearings, surfaces on shafts for ball or roller bearing assemblies, etc.

25-50 Mu. In. RMS: Produced by fine machining operations, such as medium surface grind or coarse cylindrical grind, and honing. In the case of turned parts, this finish

may be achieved by removing tool marks with emery cloth. This is the finish usually referred to as "commercial." Used for accurate sliding metal-to-metal surfaces, reamed holes, piston ring grooves, is a good finish for hardened steel parts. When specifying this or finer finishes, consider increased shop costs necessary to produce them.

50-100 Mu. In. RMS: Produced by turning, boring, buffing, grinding, hand filing, or hand finishing with emery cloth, reaming, burnishing and similar methods. These are the finishes normally produced by commercial semi-finish turning, boring, and grinding operations.

125-150 Mu. In. RMS: Finishes normally produced by coarse rough machining operations.

250-750 Mu. In. RMS: Rough machine finishes produced by heavy turning, boring, shaping and grinding operations. Suitable for clearance surfaces that are not subject to vibration.

Over 750 Mu. In. RMS: Very coarse machined surfaces produced by "hogging" cuts with heavy lathe and planer tools, flame cut edges of steel plates, etc. Usually for clearance where smoothness is no object and where furrows are clearly visible and easily felt.

Specimen Blocks Find Many Uses

USE OF actual parts with surfaces finished to the roughest acceptable quality as "not go" gages (visual inspection and feel) has been practiced for years. Many companies have also made finish reference standards for use by their inspectors and machine operators when critical surfaces were to be produced. Usually these standards are small blocks or cylinders made of the same material, and finished by the same methods, as the parts to be inspected.

During World War II, standard surface finish specimens gained popularity rapidly. They were used for training machine operators and inspectors quickly, and for samples for subcontractors. They usually were made to conform with the preferred values of microinch rms surface roughness listed in one of the standards then current for ordnance and aircraft equipment.

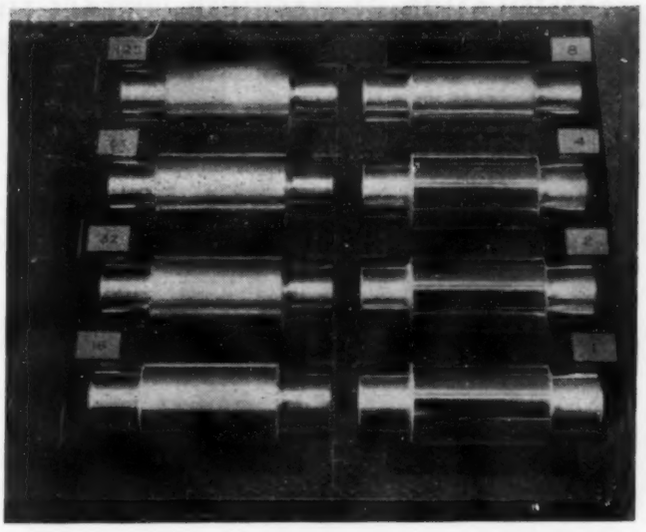
On the other hand, some companies in the heavy-industries group found that required finishes were of a different number of steps. For example, Joshua Hendy Iron Works selected the following:

1. Extra smooth finish (32 mu. in. rms).
2. Smooth machine finish (63 mu. in. rms).
3. Medium machine finish (250 mu. in. rms).
4. Rough machine finish (over 250 mu. in. rms).

Later it was found desirable to add a 125 mu. in. rms surface. Standard finish blocks were made up in sets of eight blocks. One of each finish was prepared by planing. Three blocks—Nos. 2, 3, and 4 finishes—were prepared by a lathe facing operation, and one block (No. 2 finish) was prepared by face milling. Separate sets were made up in steel and cast iron.

All of the original sets of comparison blocks were individually machined and expensive. Soon less expensive replicas in metal and plastics were adopted by a number of companies.

Because surfaces machined by different methods have somewhat different qualities, even when they show the same average height value when measured with a stylus tracer instrument, these sets contain replicas of surfaces of several roughness values originally produced by turning, milling, shaping, grinding, honing, lapping, etc.



Eight cylindrical steel specimens (Norton) are individually finished to the microinch rms value indicated on the tab beside it in the rack

Special sets are used where standard sets are not entirely suitable. For example, the Fine-Pitch Gearing Committee of The American Gear Manufacturers Association has been developing standards for evaluating surface roughness of gear teeth. Martin (96) describes a surface roughness comparator representing seven types of surface finish, three grades of roughness in each type, prepared from gear teeth. The seven finishing methods include: hobbing, shaping, milling, burnishing, shaving, grinding and lapping.

One important point to remember is the desirability of making qualitative comparisons with specimens of like or at least similar materials. Comparisons between stainless-steel standard specimens and aluminum or magnesium parts can be misleading. Because of their structure, aluminum and magnesium surfaces invariably "feel" smoother than equally rough parts made from other metals. Until the inspector or the machine operator learns to make allowance, particularly between ferrous and nonferrous metals, a stylus instrument should be used to measure a representative piece.

Wherever possible, comparisons of this type should be made between surfaces finished by similar machine operations. A shaped or planed surface, for example, can be compared with a lathe cut, because the operations employ similar tools. But, generally speaking, a turned or milled specimen should not be compared with a ground or honed work surface.

Kinds of Commercial Surface Specimens

A NUMBER of companies now are making sets of specimen blocks for surface quality control purposes. Some of the available sets are:

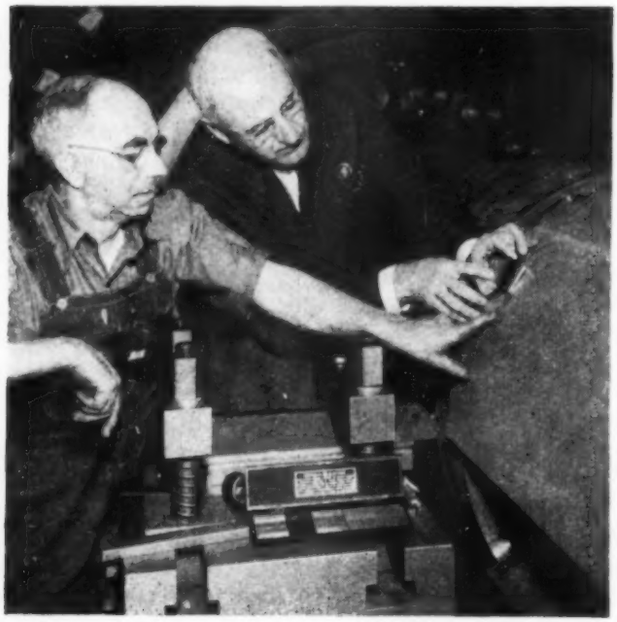
Norton Specimens—Eight cylindrical steel specimens having graduated roughness of 1, 2, 4, 8, 16, 32, 63, and 125 mu. in. rms as checked with a Profilo-

CLASSIFICATION OF MACHINED SURFACE FINISHES

SYMBOL*	CLASS	ROUGHNESS MICRO-INCHES AVERAGE	ROUGHNESS MICRO-INCHES AVERAGE PEAK TO VALLEY	SUITABLE FOR TOLERANCES OF PLUS OR MINUS (Unless otherwise specified)	DEFINITION OF FINISH	TYPICAL METHOD OF PRODUCING FINISH (Does not include all methods)	APPROX. RELATIVE COST TO PRODUCE
A	Super Finish	4	15	0.0005"	Mirror like surface without tool, grinding, or file marks of any kind.	Ground, micro-honed, lapped, burnished, buffed, to best surface possible.	40
B	Polish	8	28	0.0005"	Smooth finish with very close tolerance limits and without scratches.	Ground, honed, lapped, burnished, etc.	35
C	Ground	16	56	0.001"	Smooth finish with close tolerance limits.	Ground, rolled, filed, lapped, etc.	25
D	Smooth	32	118	0.002"	Bearing surface where accuracy is essential and tool marks objectionable.	Square nose tool with drag feeds to suit. Ground, rolled, filed, milled, etc.	18
E	Fine	63	220	0.003"	Smooth surface without objectionable tool marks; moderately close tolerance.	Shaped, milled, ground, reamed, rolled, broached, etc.	13
F	Semi-Fine	125	455	0.004"	Surface requiring good finished appearance or where fairly close dimensional accuracy is essential.	Shaped, ground, broached, milled, etc.	9
G	Medium	250	875	0.007"	Where good surface contact is essential, such as machined parts, etc.	Shaped, rough ground, milled, turned, bored, drilled, spot-faced, etc.	6
H	Semi-Rough	500	1750	0.013"	Where close tolerance is not required for parts in bolted or riveted assembly, when uniform bearing area is needed.	Shaped, rough ground, milled, turned, bored, etc.	4
J	Rough	1000	3500	0.025"	Rough surface produced by removing stock to nominal dimension.	Round nose tool, 3/64" to 1/4" feed.	2
K	Clean Up	2000	7000	0.050"	Very rough surface produced by removing excess stock to approximate size for clearance or appearance.	Round nose tool, 3/32" to 3/8" feed.	1

*Refers to General Electric Standard Roughness Specimens.

Classification of surface finishes, as adopted by Carnegie-Illinois Steel Coporation, is based on standard General Electric roughness specimens. Method and procedure of obtaining the various required finishes may vary according to size, shape, design, or contour of the work



Specimen blocks are easily removed from a General Electric set for close comparison with the job

meter. Each specimen is within plus or minus 15% of the standard value it represents. Special sets have been made up to conform with the NAS-30 standard in the lower preferred values.

Boneham & Turner Specimens—Six plug-type gages having finishes in a graduated range in micro-inches (h_{ave}) as follows: 2 (Superfinished); 4 (fine ground); 8, 12 and 16 (commercial ground); and 24 (rough commercial ground); as checked with a Talysurf. They are made in England by Boneham & Turner, Ltd.

General Electric Specimens—An electroplating method is used for producing accurate replicas from a master plate. As reported by Mikelson (111), a thin lead plate is pressed against the master surface to produce a negative impression. When the lead is pulled away from the master, a nickel coat is electrodeposited, then copper is electrodeposited over the nickel to provide strength. Combined coats are

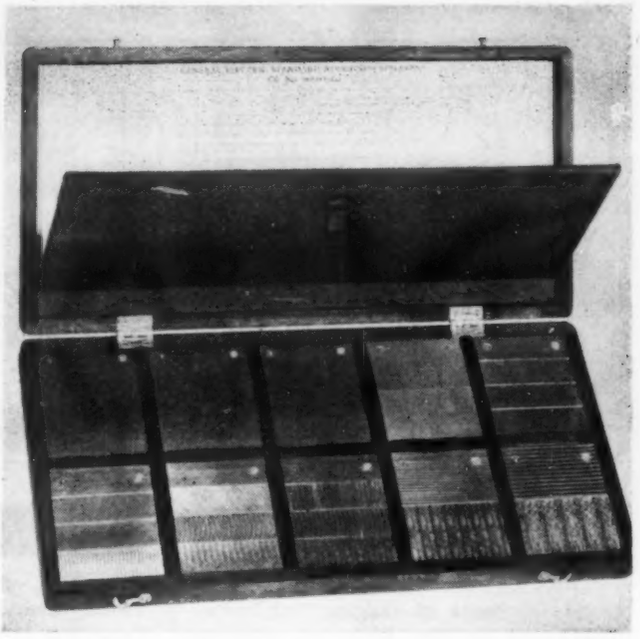
pulled away from the lead, yielding a positive imprint of the master on the nickel. The sheet then is backed with additional material for rigidity. Finished specimens are guaranteed to be within minus 25%, plus 15% of the nominal designated value.

Commercial specimen sets have ten blocks with average (rms) microinch values of 4, 8, 16, 32, 63, 125, 250, 500, 1000 and 2000. Lower limit was selected because tests of experienced inspectors and production men indicate that 4 mu. in. rms is the limit below which roughness cannot be judged satisfactorily by feel.

Surfaces processed by different methods have different appearance, even with same depth of irregularities. Hence several of blocks are subdivided into two or four different surfaces; all surfaces on any one block have the same degree of roughness, but surfaces are produced by different processes.

University Machine Co. Specimens—These are machine-cut stainless steel specimens guaranteed to be within plus or minus 10% of the stated microinch rms value. Latest set is the "University Type 7 Standard" which conforms to the preferred number series of American Standard B46.1-1947. The surfaces furnished in this 20-specimen set are: 2, 4, and 8 mu. in. rms polished; 16 and 32 mu. in. rms ground (straight and Blanchard); 63 mu. in. rms shaped, turned and ground; 125 mu. in. rms shaped, turned, milled and ground; 250 and 500 mu. in. rms shaped, turned and ground.

Ecko Comparators—Developed by Electro-forming Department, United States Rubber Company, comparison specimens are nickel-faced iron, reproduced from masters by electroforming. Each comparator contains 18 representative standard surfaces. Two sets are available: one follows American Standard values and the other the S.A.E. AS-107A values.



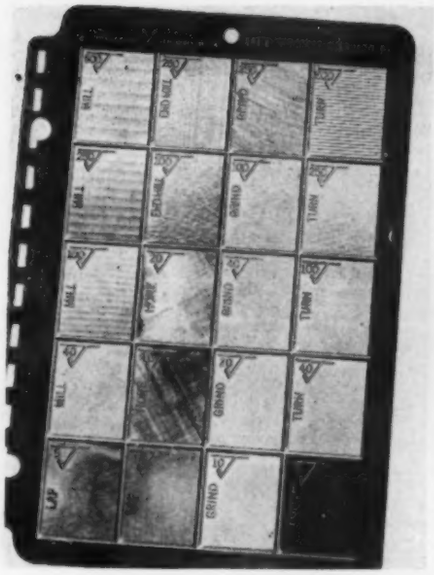
Ten replica blocks in the General Electric set represent surfaces ranging from 4 to 2000 mu. in. rms. Seven blocks have two or more surfaces, produced by different machining methods, but all surfaces are of the same roughness rating

The former ranges from 2 to 500 mu. in. rms; the latter ranges from 3 to 200 mu. in. rms.

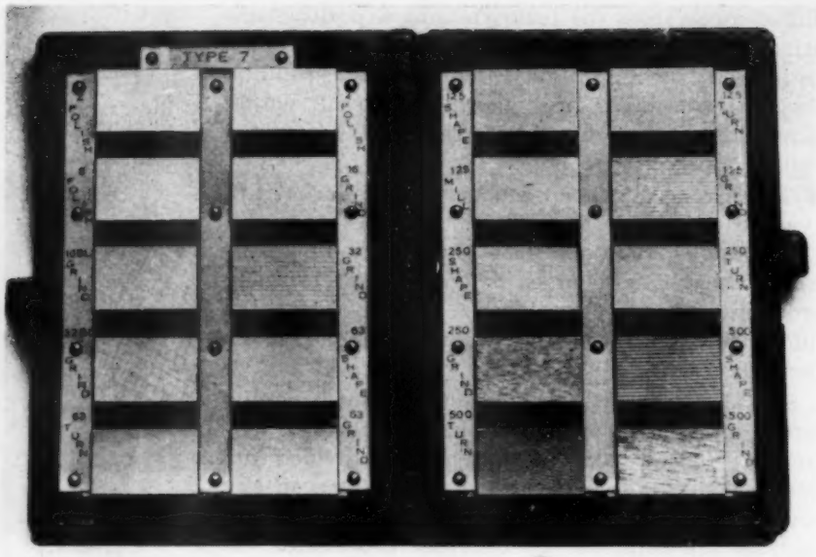
Lockheed Aircraft Specimens—A set of six aluminum-alloy samples mounted in a cardboard holder was produced during the war by Lockheed Aircraft Corporation. Surfaces were made from 61 SW aluminum alloy sheet to correspond with ground surfaces corresponding to values of 10, 20 and 40 mu. in. rms, and turned surfaces of 100, 250, and 500 mu. in. rms. A similar set now is being made by

Ekko surface roughness comparators are electroformed plates of nickel-faced iron construction having accurate reproductions of 18 surfaces

Six faces of this N-H Gage Co. comparator are made of anodized 61 SW aluminum, correspond to 10, 20, and 40 mu. in. rms. ground surfaces and 100, 250 and 500 turned surfaces



Twenty surfaces of varying roughness, conforming to the preferred number series in National Aircraft Standard NAS-30, are shown on this Surf-Chek plastic replica plate



Twenty machine-cut stainless steel specimens are included in this "University Type 7 Standard" set made by University Machine Company Division of Baird Associates

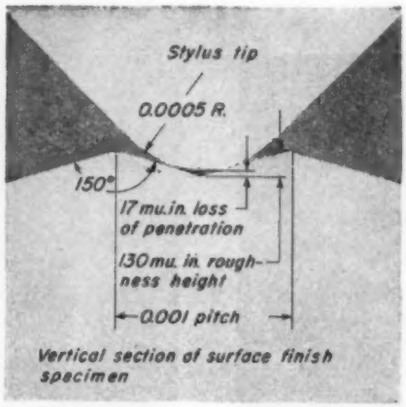
N-H Gage Co.

Surf-Chek Surface Roughness Specimens—Developed at North American Aviation, the Surf-Chek plastic specimen gage shows replicas of 20 surfaces of varying degrees of roughness. It is now made by Surface Checking Gage Company. Comparison is made by scraping a fingernail over the work and the replica.

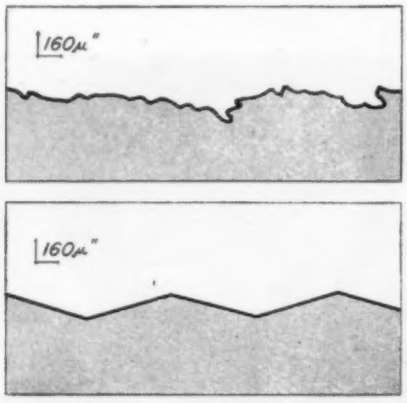
Geometric Standard Blocks—Standard surface finish specimen blocks which are exceptionally accurate, plated reproductions of *geometrically ruled masters* have been developed as the result of two years of cooperative research of two large corporations in the mass-production field. These blocks are expected to serve as standards in three fields of surface-finish evaluation:

1. To establish and maintain production control of machine processes. Such control is effected by using the blocks to calibrate a pilot piece. Having obtained the desired finish on the part and established the proper machining conditions to produce that finish, the pilot piece may then be used by the inspec-

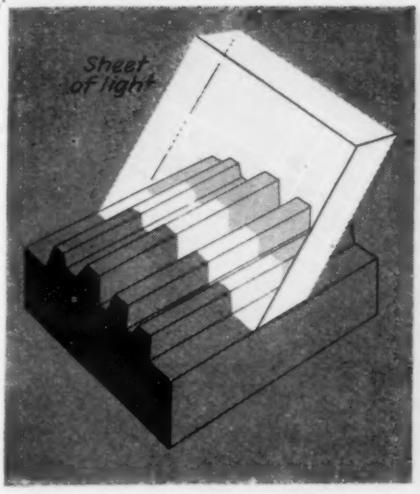
Ranging in roughness (peak-to-valley height) from 1 to 1000 microinches, the "geometric" surface finish standard blocks will be removable from their metal case in groups of three or four to facilitate instrument comparison with production surfaces, or for use as reference standards when calibrating instruments



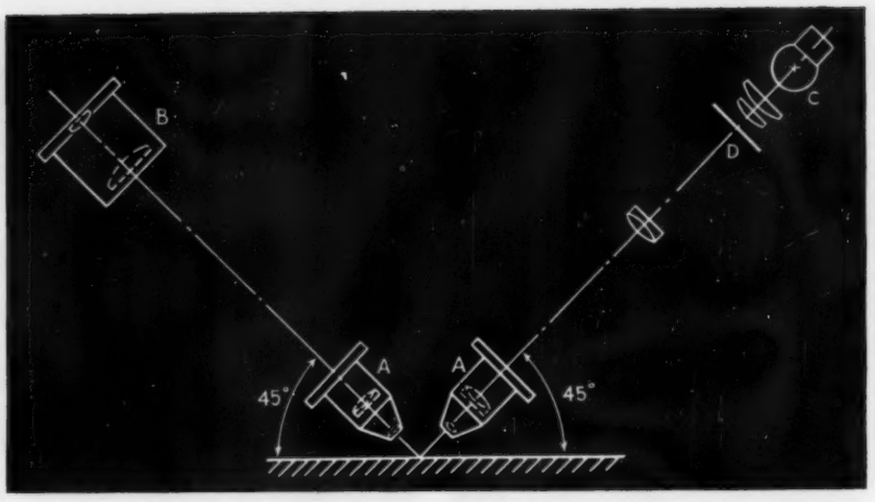
Included angle of parallel grooves ruled in face of gold-plated master for geometric standard blocks varies from 127° on coarse finishes to 170° on fine finishes. Pitch (roughness width) varies from 0.004 to 0.0002 in. Angle of ruling, for a 150° groove, allows deep penetration of diamond-pointed stylus of size (500 mu. in. radius) commonly used on tracer instruments



Actual trace of 150-microinch average peak-to-valley height ground surface enlarged 1200X (above) shows irregular characteristics which make it less desirable for use as a standard than the geometrically ruled surface of 160-microinch average peak-to-valley height roughness (below) which has been sketched to the same magnification



In the optical cut method of optical inspection, peak-to-valley distance of scratches is measured by micrometer adjustment of reference line in microscope objective



In the Schmaltz optical cut microscope, light from lamp *C* passes slit or straight edge *D* and is directed onto surface at 45° by objective of illuminator. Light film reflected from surface is viewed in microscope ocular *B*

tor or operator as a visual or tactual comparator for parts subsequently produced.

2. The blocks establish a yardstick or primary reference for depth of irregularities in millionths of an inch, comparable to the reference standard that scales, verniers, indicators and micrometers provide for measurements of greater magnitude. They also help to clarify the nomenclature of surface-finish evaluation.

3. The accuracy of these specimens makes them suitable for calibration of stylus-type instruments. Unskilled operators will have available reference standards to help them make repetitive measurements with consistent accuracy. The geometric specimens also help to compensate for the inaccuracies introduced by non-uniform adjustment of instruments and differences in operating conditions.

The standard set will provide 27 roughness values in increments from 1 to 1000 microinches—the values being the average peak-to-valley measurements to an accuracy of plus or minus 3% for coarse finishes and plus or minus 10% for fine finishes. Included angle of the geometric ruling on each block (see sketch) varies from 127-deg. on the coarse finishes to 170-deg. on the fine finishes with respective peak-to-peak spacing, or pitch, varying from 0.004 to 0.0002 in. The pitch values are within the frequency range of available surface measuring instruments, the angle of the ruling allowing a deep penetration of the instrument stylus as shown.

The accuracy of the rated depths of the geometric specimens is two to three times greater than that of any other existing standard. Each ruling of the specimens is within 10% of the rated depth as contrasted with appreciable inaccuracies in machined, ground or lapped specimens.

The specimens will be housed in a thin, pocket size (4½ x 6⅜ x 13/32 in.) metal case. Replicas are being produced directly from the ruled masters with the Eko process by the Electroforming Division of the United States Rubber Company. Sets of these replicas are expected to be available sometime late this year.

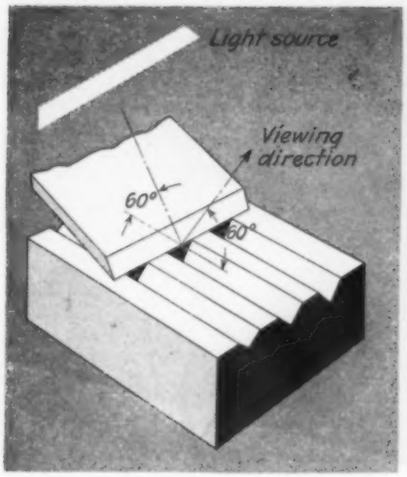
Many Optical Inspection Methods Available

Visual examination is the most widely used method of surface examination, and the one most subject to human error. As surface irregularities decrease in size, the difficulty of correct interpretation multiplies rapidly. Data provided by Schmaltz (15) indicates that at a distance of 10 in. the unaided human eye can separate two points 0.003 in. apart, and can detect scratches 30 microinches wide. But the eye cannot evaluate them consistently.

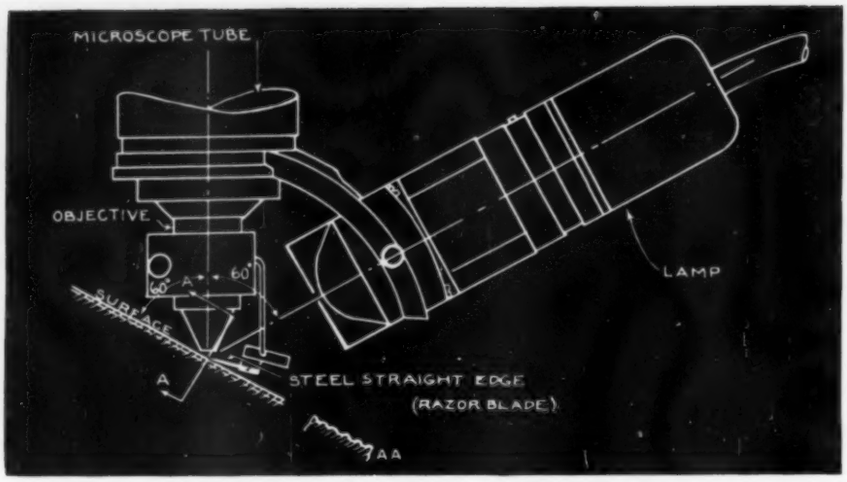
Better practice is to use a 7 to 25 diameter magnification microscope. Low-power magnification is preferable. Illumination of the surface is important. Oblique (dark field) lighting is preferred for smooth surfaces; parallel lighting (light field) and low magnification helps when studying long waves or scratches difficult to detect by ordinary methods. Varying the angle of illumination gives an idea of surface profile dimensions. A vernier scale sometimes helps to study depth of scratch penetration, by measuring vertical adjustments to maintain focus from peak to valley.

Normal use of the microscope provides qualitative information of the plan view of a surface. With an ocular scale a quantitative measure of surface roughness width is obtained. However the binocular microscope gives a stereoscopic effect, so depths of irregularities can often be estimated by comparison with a surface with scratches of known depth. A permanent record can be made by taking a pair of stereoscopic photomicrographs through the binocular microscope.

Resolving power of a microscope is limited by the wavelength of the light used. Under ordinary con-



Way's straightedge shadow method of studying surfaces optically also can be employed without damage to finely polished surfaces



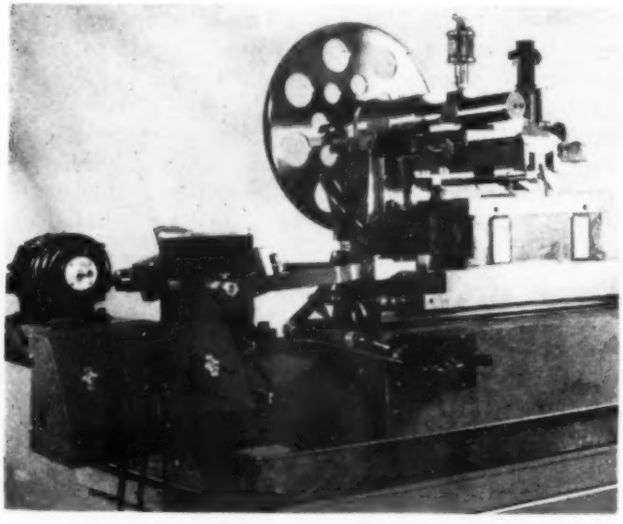
Equal vertical and horizontal magnification of the image is obtained by the 60° angular settings of elements an Way's instrument for checking surface with the straightedge shadow method

ditions, at highest magnification, points 20 to 40 microinches apart can just be distinguished. In many cases, depths of irregularities are below this limit.

Photomicroscopes provide a method for studying enlarged plan views of surfaces, by projecting the image onto a screen, where it can be photographed or qualitatively compared with standard samples. Typical instruments are the Vickers projection photomicroscope made in England, and the Busch "Metaphot" made in Germany prior to the war.

"Light-Slit" Optical Inspection

Schmaltz (15) developed an optical means of obtaining a profile curve of a surface based on the principle of the *optical cut*. An illuminator projects an image of a slit onto the work surface. View through microscope shows band of light running midway through a darker field. Only one of the two slit edges can be seen sharply at one time, and usually the two edges are parallel. By causing a reference line in the microscope objective to coincide with the upper peaks of the image, and then shifting the gage line to roots of the valleys, by micrometer adjustments, the profile height is measured in microinches.



Special ruling machine constructed for grooving master geometric surface finish blocks in roughness range above 50 microinches (peak-to-valley-height) is driven by a 1/70-hp. motor. Table traverse speed ranges from 1 to 10 in. per sec. Machine is set up in location selected for freedom from vibration and temperature variations to insure accuracy of cuts

Usually three sets of objectives will cover the range of rough-turned surfaces (profiles 0.0006 to 0.0020 in. high) to finely ground surfaces (0.00004 to 0.00020 in. high profiles). Irregularities of about 0.00004 in. (40 microinches) height represent the limit to which this method can be applied. The instrument is especially adaptable to turned or ground surfaces where scratches run in the same direction. Greatest length of surface that can be examined at one time is about 0.22 in.

Frischmuth (89) described a number of German optical instruments arranged for using the "optical cut" or "light slit" method of examining surface.

In a variation of the *optical cut* method devised by Way (16, 26) the shadow of a straightedge (razor blade) is thrown on the surface by an illuminator placed at 60° with surface. Microscope is mounted at 60° with respect to both illuminator and surface (see sketch). The 60° angles are used for maximum illumination and to secure identical vertical and horizontal magnification. The 45° angles of the Schmaltz optical cut microscope fulfils the first of these conditions, but not the second. Straightedge shadow on work (see sketch) is thus viewed with microscope as the true shape of the profile. A photomicrograph can be taken of this shadow for a permanent record. The straightedge-shadow method makes it just possible to observe irregularities as small as 0.00003 to 0.00005 in. (30 to 50 mu. in.) in height. Coarse irregularities can also be studied easily.

Part II—"How Smooth Is Smooth?" will appear in an early number.

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University Machine Company
Van Norman Machine Company
Waukesha Motor Company
Westinghouse Electric Corporation
Willys-Overland Motors, Inc.
Wright Aeronautical Corporation

TALKING SHOP

Thou Shalt Not

LISTENERS who filch "bouncing putty" from the large ball that G.E. Lecturer Irwin uses as a prop have a uniform problem—a pocket lined with the silicone product. It makes a fascinating toy—can be stretched like taffy or torn like paper (depending on speed), can be shaped like putty yet bounced on the floor. But, left to its own devices, it "melts" like ice cream—in these cases into the fabric of pocket linings. And while G.E. has just developed a silicone adhesive, no cleaner has developed a solvent that will take the stuff out. So if you are going to purloin some, better bring a can.

Gear Specs

L. P. TARASOV, research engineer for Norton Company, made two points about gear specifications in a talk at the AGMA Convention that deserve frequent repetition. First is that many hardened gears are specified with only a lower hardness limit. If a batch comes through several points over that limit, they meet the spec, but when they're ground as usual, there's an epidemic of cracking. The other case is with high-carbon steels, which if burned on cut edges by friction saw or abrasive cutoff wheel, may ruin tools during machining.

Golf Progress

To CUT 10 strokes off his golf score, one metalworking manufacturer has designed and is making a new golf club. Instead of the traditional offset head, the new club has a centered head, like a konb. Obviously, it cuts the hazard of slice or hook from a misaligned swing. But the golfers we know will yell, "Unfair!"

Impregnated Fords

POWDERED-METAL PARTS, impregnated with oil, are being used extensively in 1949 Fords, Mercurys and Lincolns. Typical parts are bushings and pistons in shock absorbers, steering-assembly bushings, generator and starter bearings and bushings, distributor bushings, windshield-wiper bushings and clips, clutch cross-shaft bearing and pilot-shaft bearing, oil- and water-pump bushings, bushings in small electric-blower motors for air-conditioning units, and in various accessories. Parts are in many cases stronger than solid metal, avoid tough lubrication problems.

Vertical Transportation

MORSE CHAIN has solved a handling problem in its multi-story Ithaca, N. Y., plant. A Yale electric trolley hoist with extended control cable was mounted on an I-beam extending out over the plant yard from a third-story opening. The hoist lifts sheet steel from the yard to the third floor and brings it in. Three pairs of grips on an equalizer beam enable a dozen or more sheets to be lifted flat at a time. This prevents deformation of sheets by conventional hoisting in a sling. Time is cut seven-eighths.

Impossible?

CAN THE CIRCUMFERENCE of a circle increase without a corresponding increase in diameter? Mathematics says it's impossible, but just this condition occurs when a circular friction saw comes up to speed. Such saws may be 58 in. in diameter and operate at 28,000 rpm. Centrifugal force is far greater at rim than at hub, so the periphery actually lengthens without an equivalent increase in diameter. This would cause the rim to ruffle or flutter. To prevent it, both faces of the blade are peened from hub to within a few inches of the rim, stretching this area and putting initial tension in the rim. Then when the rim expands at high speed, there is no flutter.

Semi-Underground

SMITH & WESSON, Springfield, Mass., has just completed a semi-underground plant that combines war-plant potential with production savings. All production machinery is above ground, but there is room in underground chambers of heavy reinforced concrete to handle it. Above-ground walls slide up like garage doors to provide air circulation—and will blow out in case of explosion.

Underground tunnels (materials transport) are 15 ft. wide, connecting air-raid shelters (storage chambers), are designed for truck transportation, connected to rooms above by ramps, elevators, and protected stairwells. Standby transformers line tunnel walls. Underground concrete floors are topped by a layer of felt between two moppings of tar, in turn topped by concrete. Working areas have wood block over this. The usual air-tight bulkheads and steel-faced fire doors are provided, as well as ventilation. Sanitary facilities, etc., provided for personnel. Cost will be about $6 per sq. ft., aided by low-cost swamp land bought at $35,000 for 126 acres—which now sports two fighter airstrips and a lake (which doubles as a source of water for fire protection, etc.)

Handicapped Vets Handle Jobs Normally In Production

Minor changes in work and tooling setups allow handicapped workers to prove they can keep up with normal plant routine

By SAMUEL STANLEY

Operating a drillpress in his own woodworking shop, Edward Bengyak handles the feed with his work hook. When working with a circular table saw he holds and feeds the material with the hook

Handling a circular saw was possible for George Murphy after a wood block was clamped to the table to stop the carriage. This addition was found to be a fatigue-reducing safety device for all workers

THE 23,261 jobs filled by handicapped workers through the New York State Employment Service in 1947 prove that sightless, armless and legless veterans can handle top-grade production work. Much of the credit for the fine record of employment goes to Martin Mahler, himself a blinded industrial engineer.

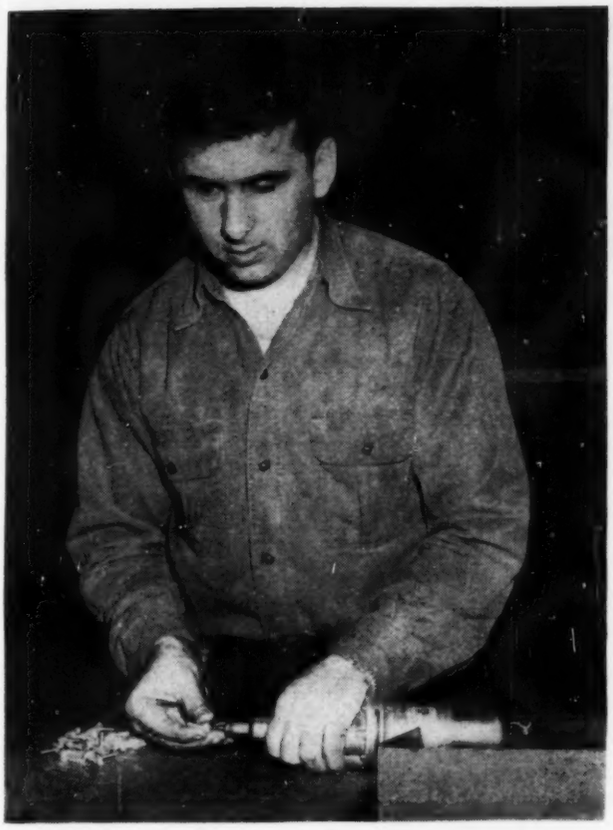
Mahler was working as a foreman in a cigarette-lighter factory when he requested permission to hire disabled veterans. Because he has demonstrated his own ability to carry on a job without vision where it was normally required, he received a go-ahead signal.

Shortly thereafter, two blind workers ran out of material for their operation—one that was considered simple enough to give them no trouble. Instead of sending them home, Mahler hunted around and found two other jobs—more difficult ones—that were waiting for operators. He devised manual guides on the spot and the two men went to work.

It was only after the regular operators came back to the jobs that Mahler realized that he had followed through on an important industrial-engineering principle. The work guides had not only helped his blind workers, but they were almost equally desirable to workers who could see.

With the argument that the application of the best industrial-engineering principles could help disabled workers keep pace with, and even outperform, normal workers, Mahler went back to the NYSES, sold his point and started talking to manufacturers.

Mahler, working for the NYSES in an advisory capacity, has assisted in the placing of factory workers as well as technical, professional and service personnel in the last 2½ years. He averages two or three plant visits each week, coordinating his efforts with those of interviewers in local employment offices. In this work he considers himself as a technical salesman.



Assembling levers is done by Frank Rocco, a blinded veteran. He is able to perform any of ten difficult jobs with a production rate of 15 to 20% above the plant average

Tightening four screws for a bell assembly, Andrew Grantzow locates the work against two blocks aligned under the drillpress screwdriver. The sightless assembler can perform more than fifty jobs, all by touch

Locating a tube in relation to casting and coil holes with a simple tapered arbor, a blinded worker illustrates how touch is substituted for vision. Similar improvements speed up workers with full vision

As a result of this work, employers as well as employees are aware that there are now ways in which disabled persons can work alongside normal workers. The modifications in machines, workbenches and equipment are usually minor and inexpensive. Mahler believes that his loss of eyesight has been an advantage because he has gained an understanding of the attitudes of handicapped workers toward their work problems. The result is that he can recommend specific changes that will allow disabled men to maintain, and even surpass in some cases, the efforts of normal producers.

Threading and operating a complicated typewriter-ribbon spooling machine was set up for Howard Nelson by changing the height of die pins to hold ribbon eyelets and hoods more securely in the press before riveting

HOW TO PREVENT

Gear-Grinding Troubles... 1

Burning and cracking of ground surfaces are often closely related but are not always attributable to faulty grinding practice

BY L. P. TARASOV, NORTON COMPANY RESEARCH LABORATORIES

GRINDING plays a very important part in the production of gears and worms to develop high accuracy at high hardness. Unfortunately certain defects are sometimes found in a ground surface, not necessarily caused by unsatisfactory grinding practice, which lower the quality of the surface.

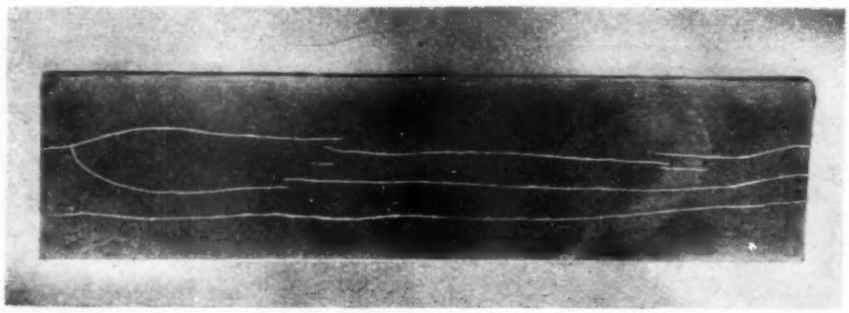
The most obvious of these defects are surface cracks, which are likely to cause premature failure in highly stressed parts. Another type of defect is burn, which may result in the softening of a surface layer with a consequent increase in wear. Finally, surface stresses accompanying severe burn may be high enough to cause the part to crack in service.

A variety of causes may be responsible for these defects, the most common being poor heat-treating, grinding, or machining practice. When cracks are present, they may be pronounced enough to be easily visible either directly or with an ordinary magnifying glass. Frequently, however, they are too fine to be distinguished so readily, or are covered over at least partly, by flowed metal. Other methods are then required to reveal them.

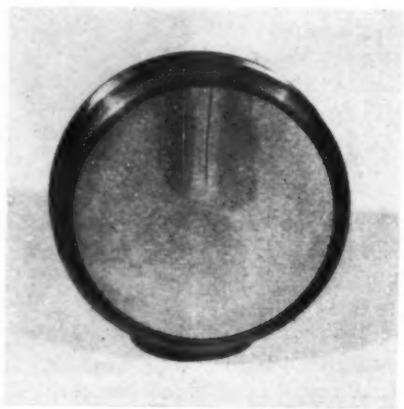
The most satisfactory method for steel is magnetic particle inspection, such as Magnaflux. Another way is to etch in nitric acid at room temperature. Etching for a quarter of a minute in a 5% solution of concentrated nitric acid in water will not widen the cracks appreciably, but when the surface is washed in running water and wiped dry, the acid remaining in the cracks will seep out and discolor the surface at their borders, making them easy to detect. Aside from the discoloration of the surface, this etchant is nondestructive as it does not remove any appreciable thickness of metal. After etching, the surface should be neutralized in an alkaline solution to prevent rusting.

Typical Crack Patterns

An understanding of crack patterns will be helpful in distinguishing between heat-treatment cracks and those occurring during or after grinding. The principal distinguishing characteristics of heat-treatment cracks are that they are fairly large and deep, and bear no relationship, unless an accidental one, to the marks left by the grinding wheel.



Cracks in a bar of hardened tool steel, caused by improper heat treatment, are deep and on a large scale



Depth of a heat-treatment crack is evident in this section through a hardened steel roll

Radial cracks in internally ground flat surface are at right angles to the concentric grinding marks

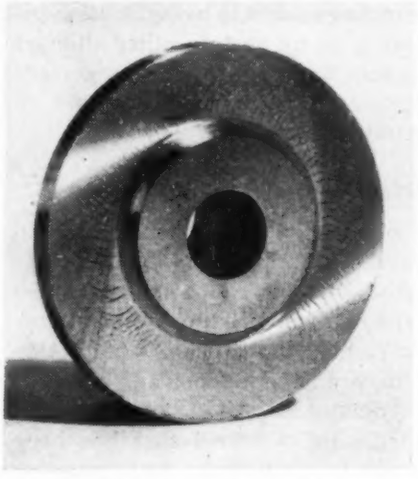
Digest of a paper presented at the AGMA Annual Meeting, June 1948

On the other hand, cracks formed during or after grinding are small and shallow, and are definitely related to the pattern of grinding marks. It should be kept in mind that such cracks are not necessarily the result of faulty grinding, since improper heat treatment also may stress a piece of hardened steel so much (without actually cracking it) that even a very gentle grinding operation will then crack the surface.

Several types of crack patterns are associated with grinding operations. In flat surfaces, as in gear hubs, the surface cracks are primarily perpendicular to the grinding marks. Cracks in curved surfaces may be perpendicular to the grain marks, but in many cases they are parallel instead. The latter is very likely to occur when worms are ground. Sometimes both types are present in the same piece, one more pronounced than the other.

Still another type of cracking sometimes found in ground surfaces is known as spalling. Here the cracks are shallow but they turn parallel to the surface and join similar cracks starting elsewhere, causing flakes to spall out.

Cracks in hardened tool steel, caused by too severe grinding, are shallow and on a comparatively fine scale



Spiral cracks are perpendicular to the tangential grinding marks produced by cylindrical grinding with the side of the wheel

Nature of Burn

A hardened steel part need not be cracked to be injured for some purposes. Often the momentary high temperature which the surface reaches locally during severe grinding contact is enough to discolor the surface in spots. This visible burn color is a warning that the physical condition of the metal immediately underneath may have been seriously affected by the high temperature.

The heat of grinding may temper hard steel, either in spots or in the whole surface layer, the result being known as soft skin. When even higher temperatures are reached momentarily, the steel surface may harden if it was previously in the annealed condition, or it may reharden if it was already hard. A hardened steel rehardened by grinding will be unusually brittle because the rehardened areas are not tempered. In addition to these possible hardness changes, the surface may become highly stressed in tension when it is burned. Such stresses are thought to lead to premature failure of parts under severe service conditions.

Although all traces of visible burn are often cleaned off in the final passes, any hardness changes or stresses resulting from the momentary high temperatures remain in the surface layers of the steel.

Detection of Burn by Etching

Hardened steel that has not been tempered remains light in color when etched in nital, an etchant containing several percent of concentrated nitric acid in methyl or ethyl alcohol. Tempered steel, on the other hand, darkens when etched, the degree of darkening increasing with the tempering temperature. Hardened steel that is to be ground is likely to be in a tempered condition, and it will etch a light or medium gray.

Areas softened by severe grinding will etch darker than the portions not affected. Thus it is possible to bring out the effects of grinding heat when all traces of visible burn color have been removed. The simplest way of doing this is to etch for 30 sec. in 5 or 10% nital. The contrast between tempered spots and the rest of the steel is only moderate but is generally satisfactory. High-speed steel, which is much more resistant to etching, may have to be etched for several minutes in a 10% solution of nitric acid in water.

When the grinding conditions are particularly severe in the case of hardened and tempered steel, certain spots in the surface may reach such a high temperature that they become rehardened because they cool instantaneously to the temperature of the rest of the steel, which is relatively cold. If the visible burn marks are ground off and the piece is then etched in nital, the rehardened spots appear white. The area adjacent to each rehardened area must have reached a fairly high temperature, not enough to cause rehardening, but enough to cause considerable softening, and for this reason it appears dark on etching.

A procedure has been recently developed to improve the sensitivity and contrast attainable with burned surfaces of hardened steels other than high-speed steel. This involves etching for 15 sec. in a 4% solution of nitric acid in water, rinsing in hot water and then in acetone, and finally etching for 15 sec. in a 2% solution of hydrochloric acid in acetone, followed by rinsing.

After a part has been etched to detect burn, all traces of acid must be neutralized. A few minutes in a weak solution of ammonium or sodium hydroxide suffices.

The detection of burn by etching is, in most instances, nondestructive. Parts inspected for burn by etching can generally be placed in service without any noticeable effect upon their useful life.

Sensitivity of Steels to Grinding

Although the immediate and apparent cause of grinding cracks and burn is grinding, the real cause may be something entirely different. For example, heat treatment may leave hardened and tempered steel in such a sensitive condition

that it cracks readily even when ground with reasonable care. Although it may be possible to eliminate cracking by grinding the sensitive steel more gently, this would raise the production cost. The proper way to eliminate cracking would be to reduce the sensitivity by improving the heat treatment.

Many hardened gears and worms are made from carburized steels and this material gives the greatest trouble in grinding. It has been found to be highly sensitive when there is too high a carbon content in the outer portion of the case. This excess carbon is present as iron carbide, or cementite, which is a hard, brittle, nonmetallic substance.

The sensitivity of such carburized parts can be greatly reduced by improving the microstructure. The most straightforward way is to carburize with this in mind. However, there are many instances where this is not feasible and the problem is to get rid of the undesired excess carbon.

This can be done by permitting the carbon to diffuse into the steel so the case becomes somewhat deeper and more uniform. Diffusion is accomplished by leaving the steel at the carburizing temperature for several hours in a neutral rather than in a carburizing atmosphere.

Another way is to cool slowly from the carburizing temperature so the case is relatively soft. The thin layer containing the excess carbon can then be machined or ground off, sufficient care being taken to avoid cracking the brittle carbide. Even in the soft condition a case with excess carbon is somewhat brittle, but not nearly so brittle as when it is hardened. After this step has been taken, the part can be hardened and ground without too much risk of cracking the carburized case.

Another metallurgical source of grinding difficulty is incomplete hardening caused by retention of some of the high-temperature phase known as austenite. Experience has shown that elimination of retained austenite by multiple tempering or by certain other changes in heat treatment has been accompanied by a marked decrease in grinding sensitivity.

Other Metallurgical Factors

Steel which has been decarburized is occasionally difficult to grind, and the cause can easily escape notice. If the decarburization has not been completely removed by machining prior to hardening, or if it occurs during hardening, a wheel that has been properly selected for grinding hardened steel may start loading while in contact with the soft decarburized layer. When the loaded wheel does come into contact with the hard steel, it is likely to burn the work and may even crack it. To eliminate this difficutly, it is necessary to remove the decarburized layer prior to grinding.

Hardness specifications may be the source of considerable trouble. When a steel is harder than Rockwell C60, an increase in hardness of only one or two points may make it much easier to crack in a severe grinding operation.

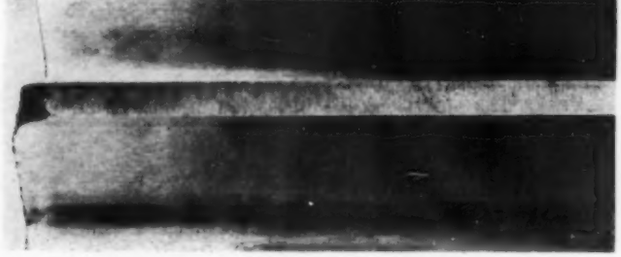
Unfortunately, hardness specifications are often written with only a lower limit. Ordinarily, the parts are hardened just above that limit and the correct grinding conditions are chosen for that hardness. However, occasional lots come through several points harder, and these are passed by the inspection department because no upper limit has been set. The result may be an epidemic of cracking which is sure to be blamed on the grinding department. The real source of the trouble is not the grinding, the inspection or the heat treatment, but rather the loosely written specifications.

Dimensional Factors

Dimensional irregularities may be very troublesome in connection with grinding. They may be due either to insufficient care being taken with prior machining operations or to distortion occurring in heat treatment.

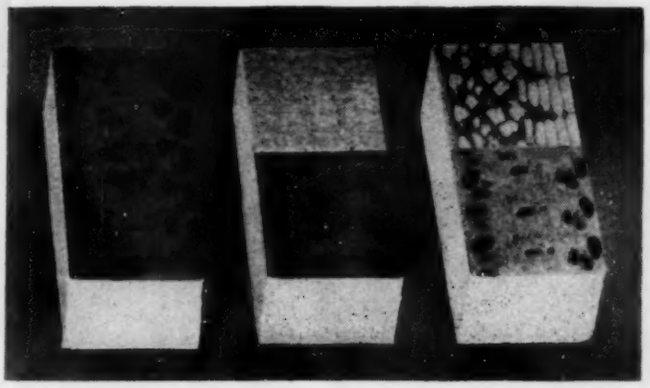
When gear teeth or worn threads are ground, machining tolerances can be made reasonably wide. However, it is necessary to set definite limits on the part when it has been completely machined; otherwise, it would not be feasible to set production rates in the grinding department. Unfortunately, there is often a tendency to leave more stock for grinding than specified, with the thought that grinding can easily take care of the additional metal. When excessive stock has to be removed in grinding without any allowance being made for it, burning and cracking of the ground surface are likely consequences.

The other common source of dimensional irregularities is distortion arising from the response of the steel to heat treatment. The extent of the distortion will depend on the steel, the heat treatment, and the design of the part.

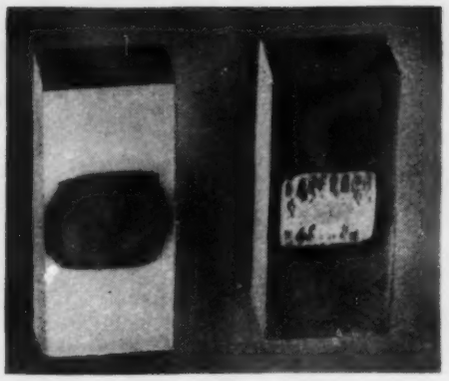


Spalling cracks caused by improper grinding of a gear tooth are parallel to the surface and usually occur with too hard a wheel and broad contact with work

Burn marks in hardened high-speed steel caused by too hard a wheel which chattered badly



Hardened tool steel severely burned when ground lengthwise. Upper half of center piece was ground crosswise, very lightly, to remove discoloration. Nital etch (right) shows rehardened areas as white spots and adjacent softened areas as dark spots



Oil hardened steel (left) burned by plunging wheel into work on a surface grinder. Careful cross grinding will remove this mark, but etching will bring out the rehardened (white) area surrounded by a softened (dark) boundary, as shown at right

Wheel Sharpness

Cracks and burn are caused by excessive heat produced in the steel at the points of contact with the grinding wheel. A dull wheel, in which the abrasive grains have flat areas in the plane of cutting, always generates more heat than a sharp wheel. Even when the abrasive grains are sharp, considerable frictional heat will be developed if the wheel is loaded.

A wheel to be used for stock removal should be dressed properly to leave all the grains as sharp as possible. After it has been dressed with a sharp diamond, continued grinding with it may cause the condition of the wheel face to change. If a wheel is on the hard side for a given operation, the abrasive grains will be held too firmly in place by the bond to be torn out as soon as flats have developed on them; thus the wheel face will eventually become dull or glazed.

A crush-dressed wheel is less likely to burn the work than the same wheel when it is diamond dressed. This is because the abrasive grains are sharper when crushed than when formed with a diamond. This added sharpness, however, leads to a somewhat rougher finish.

An increase in the contact area between wheel and work is sometimes observed to lead to dulling of the wheel. This happens when the increased contact area reduces the force acting on the individual abrasive grains so that they no longer are torn out of the wheel face when they become dull.

Other Grinding Factors

Another important factor affecting the condition of the wheel face is the grinding fluid used. With water-base compounds, the cooling properties predominate, although these solutions also have some lubricating effect at the point of grinding contact. Straight grinding oils, on the other hand, are poor coolants but excellent lubricants. The latter property is responsible for keeping the abrasive grains sharper and for making them stay sharp much longer.

As a result of increased wheel sharpness, the momentary rise in temperature of the work at its contact with the wheel is considerably less although the temperature of the work as a whole becomes higher on account of the poor cooling characteristics of straight oil. Since the rise in surface temperature is less, there is less danger of burn or cracking when straight grinding oil can be used. The much smaller quenching effect of straight oil is probably also responsible for greater freedom from cracking.

The thread grinding of worms is almost always carried on with the help of special thread-grinding oils since experience over many years has shown this to be necessary regardless of the type of steel.

One of the most important factors in avoiding injury to ground surfaces is to choose a wheel of the right grade. Too hard a wheel will burn or crack the work, while too soft a wheel will wear too rapidly.

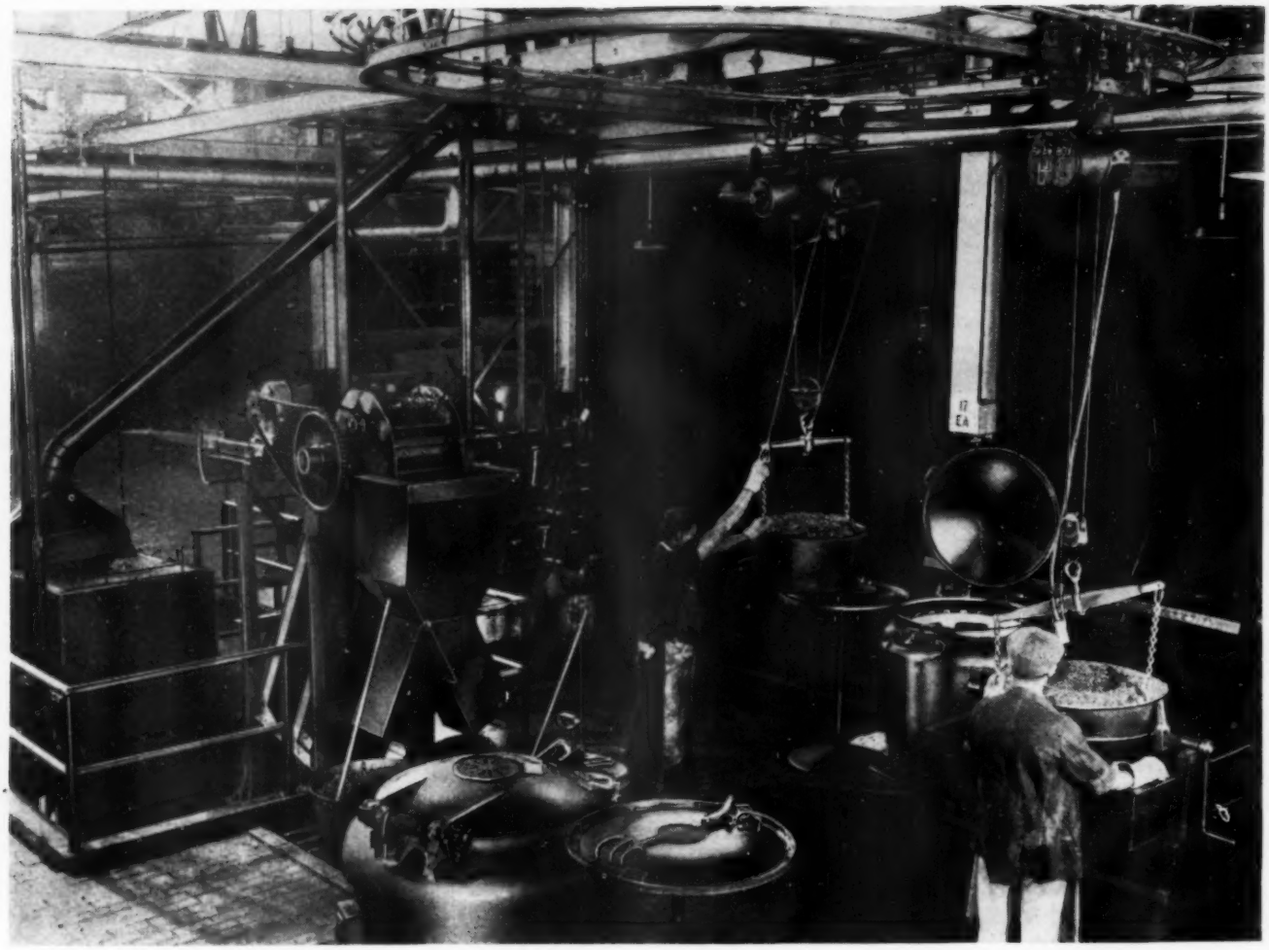
Another way to change grinding severity is to vary the infeed or downfeed. Very often a decrease in this machine variable will eliminate cracking or burn that is otherwise experienced. A decrease in the wheel speed makes the wheel act softer and thus reduces the chances of injury. The same beneficial effect results from increasing the rate at which the work moves past the wheel.

Note: The concluding part of this article will appear in a subsequent issue—Ed.

Tips FOR TOP SHOP MEN

252 Ever watch a cat play with a mouse? If you enjoy such a spectacle, better investigate your treatment of the men on whom you "have something." Don't prolong their agony; end it or forget it.

253 If you overhear yourself being criticized — *relax*. Remember the old bromide that "listeners hear no good of themselves." Later, when you've cooled down, talk over the criticism with the offender. You *may* find that he has a fair beef—and that you're growing unapproachable. Of course, you can always fire the man summarily, thus inflating your own ego —but that only amplifies the criticism—and makes it fact.



Salvage department cleans approximately 8 tons of crushed chips each 8-hr. shift in two centrifugal oil extractors. Chips are loaded into the tubs from two-way discharge chute at end of apron conveyor leading from crusher in pit at left. Tubs are handled by 1,000-lb. capacity electric hoists suspended from oval track above machines. Dumper at right discharges cleaned chips through chute to conveyor in tunnel below shop floor. Every facility to minimize worker fatigue has been provided and manual handling is held to a minimum

Conveyors, Chutes and Hoists Mechanize Chip Handling

Chips flow through salvaging operations.

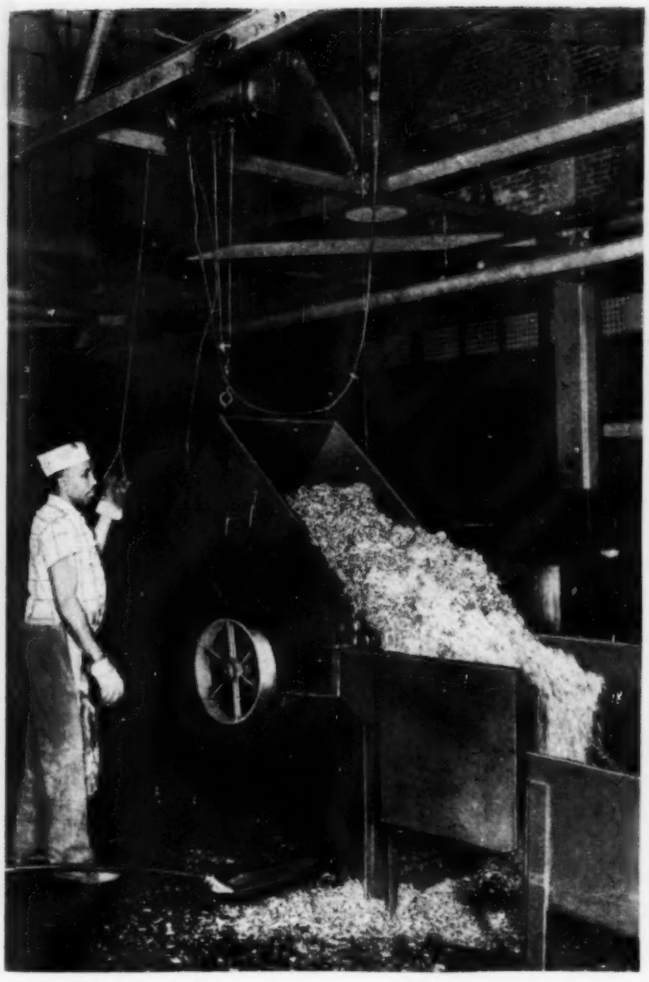
Reclaimed oil is piped back to each machine

BY ROBERT C. BECHERER, Plant Manager
Ewart Plant, LINK-BELT COMPANY

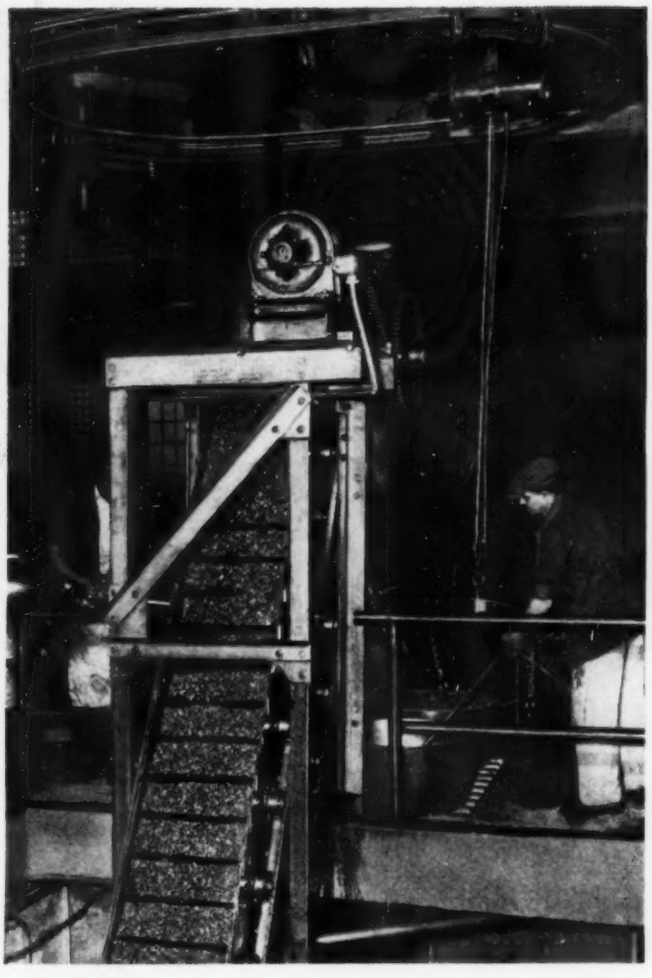
CHIPS produced by more than 150 single- and multiple-spindle automatic screw machines in Link-Belt's Ewart plant are salvaged and prepared for sale by a small group of truckers and centrifuge operators. Mechanized for most efficient chip handling, the salvage department handles approximately 8 tons of chips each 8-hr. shift and reclaims about 1,000 gal. of cutting oil per day. Only turnings and borings produced in machines using cutting oils are handled by this group; chips produced in machines using soluble-oil coolants are processed elsewhere.

Chips are collected from the screw machines in welded steel carts at regular intervals. Loads are dumped into a chute leading to an American No. 3800 crusher equipped with 1-in. grate bars. Capacity of this unit is 5 to 7 tons of chips per hour.

An 18-in. wide Link-Belt apron conveyor operat-



Dumping station has an overhead electric hoist that raises truck so chips pour into loading chute of the crusher. Chips are gathered in the trucks from screw machines and other units using cutting oils



Apron conveyor, 18-in. wide, raises chips from crusher pit to tub-loading chute. Pushbutton station at discharge chute stops conveyor if flow of chips gets ahead of centrifuge operators

ed at 30 fpm. raises crushed chips from the crusher pit to a two-way discharge chute. Chips are loaded into 30-in. dia. 4½-cu. ft. capacity tubs for adjacent Barrett centrifugal oil extractors. Only two tubs are required for each centrifuge, one being loaded at the chute while the second is in the machine.

Tub loads of crushed and cleaned chips are dumped into a vertical chute through a 30-in. dia. hole in the shop floor. This chute delivers chips to a 16-in. wide, 82½-ft. long Link-Belt oscillating conveyor that transports the chips through a tunnel to a bucket elevator beside an indoor railroad siding. This elevator loads chips directly into gondolas without attention, except for occasional repositioning of the delivery spout so the car will be loaded evenly.

The oscillating horizontal conveyor is a recent development which is proving very satisfactory for the handlng of crushed chips. It is supported on eleven pairs of arms and is reciprocated at 130 strokes per minute by a 3-hp., 860-rpm., high-torque electric motor through a reduction drive to a 43-in. O.D. flywheel on the eccentric shaft. Chute of this oscillator is made of 3/16-in. thick steel. and

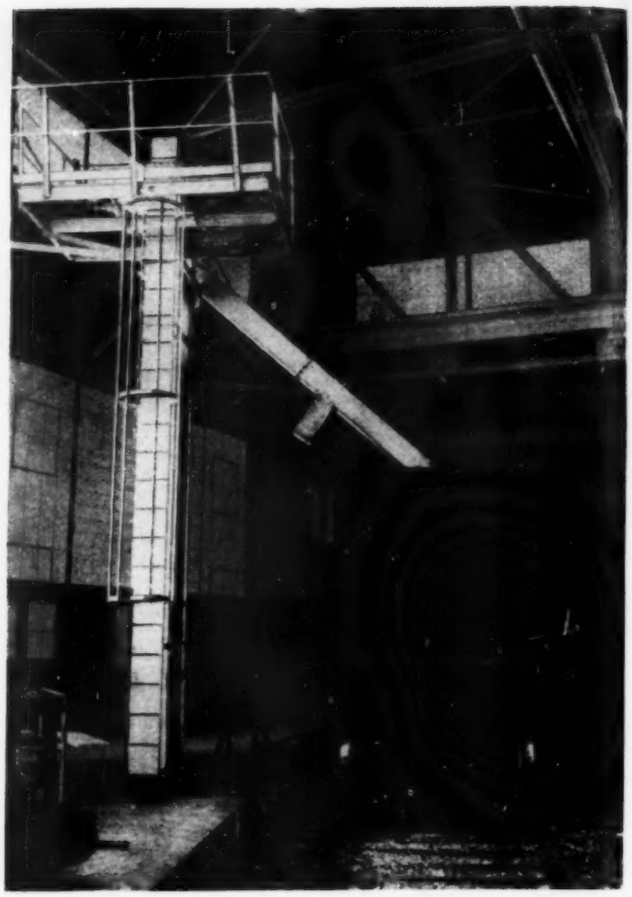
Two-way discharge chute at end of apron conveyor leads directly into centrifuge tubs. Short sections of roller conveyor make for easy movement of tubs. Long handle in side of chute controls direction of discharge

is 16 in. wide and 6 in. deep with curved sides. In normal operation, depth of chips being fed along this chute is approximately 4 in. The chips at this point have a density of about 40 lb. per cu. ft.

Used cutting oil, drained from the chips, flows to a sump in the crusher pit. It is pumped from there to a 6,000-gal. underfloor storage tank. At regular intervals, oil is pumped from this tank through a Barrett 400-gal. oil sterilizer with thermostat controls for the steam heating coils, and through a National Acme oil clarifier before delivery to a 6000 gal. underfloor clean oil storage tank. Pumps deliver oil from this tank to the various screw machines as needed, there being an oil supply pipe and valve at each machine.

Hopper into which tub loads of cleaned chips are dumped for delivery to oscillator-conveyor in tunnel. Trunnion-mounted frame holds tub with clamps while operator turns handle to dump chips

Oscillating feeder-conveyor, developed by Link-Belt engineers, transports cleaned chips through tunnel to loading chute of elevator. Driven at 130 strokes per min. by a 3-hp. motor, conveyor has chute 82½ ft. long, 16 in. wide and 6 in. deep. It is supported by 11 pairs of arms, 2½ ft. long, with rubber bearings at each end. Tunnel floor is 12 ft. 4 in. below the plant floor line



Chip elevator at car loading dock extends 25 ft. above the floor. End of delivery spout is 11 ft. 4 in. above the rails so standard gondola cars are cleared easily. Spout can be swung by handwheel at floor level to spread chips evenly in car. End of car shown has been lowered to show even texture of the crushed chips. Such chips bring a premium price, and are helping to pay for the salvage installation

"Something griping you again, McSnord?"

ROUND TABLE

Prospecting

"Goin' to stick around here all night? Come on, Ed, let's get going. I told Mabel I'd get home early so we could go to the show tonight."

"Ah, what's a few minutes going to matter, Al? I've got another problem for you to figure out."

"Well, come on; let's get moving and we'll discuss it on the way out."

"Bennet's been out all day, Al, looking around for another job."

"How'd you know that? Maybe the fellow's sick or something."

"No, nothing like that, Al. One of the boys let the news slip out as I was discussing a job and, of course, when he saw that he had let the cat out of the bag he came out with the whole story."

"Well, Ed, we pride ourselves on our liberties in this country and, as far as I can figure out, that's the man's privilege. What's particularly wrong in a man taking a day off to attend to a little business matter? You know this game of Free Enterprise is played by both sides—everybody has his inning, you know."

"I don't see why Bennet couldn't have let me know he was going to look for another job—and why," frowned Ed. "I've never turned a fellow down yet when he wanted some time off."

"The man probably thought you'd ask him a lot of questions," smiled Al. "I can readily see why he'd choose to take the day off and not say anything about it at all."

"When a man takes a day off to look for another job he shouldn't complain if he found he didn't have a job when he got back."

"I wouldn't say it was necessary to go to that extreme, Ed; almost everyone has gone through that stage sometime or another. I remember one time, back in the old days, another guy and I had a very enjoyable day being turned down by about 20 different firms."

"And when you went back to the old job you felt that it wasn't such a bad place to work after all, eh?" laughed Ed. "If you *had* gotten another job, what would have been the first thing you would have done?"

"Why, Ed, I would have walked in the shop and packed up my tools, naturally."

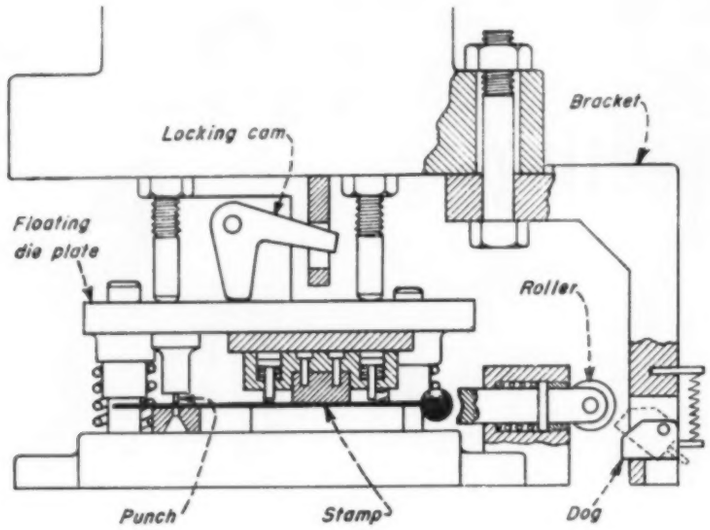
"That's what I thought you would say, and that's what makes me sore as a boiled owl about Bennet," replied Ed. "By the way, Al, did the boss ever find out you were out looking for another job?"

" 'Twas none of his business, was it?" laughed Al. "You didn't say anything to Smithers when you were on the lookout for another man to take his place, did you, Ed?"

"That's a different story, Al. He got his notice just like anybody does when we let him go. He'd been told a lot of times what was wrong with his work—Bennet should tell me what's wrong with my shop."

***SHOULD A MAN**—and a company—make known any intention to change? Is the traditional "look before you leap" policy fair to the other party? Your ideas and experiences will interest others. Discussions of earlier topics appear on later pages.*

Practical Ideas



Cam-Locking, Delayed-Action Die Force Fits Ball Handle on Upstroke

Multiple-action press dies can often be built up from standard dies to combine a number of minor actions into an efficient press job. This design, for example, utilizes a cam-locked floating punch that holds the work at the bottom of the stroke for bracing a secondary ball-fitting operation.

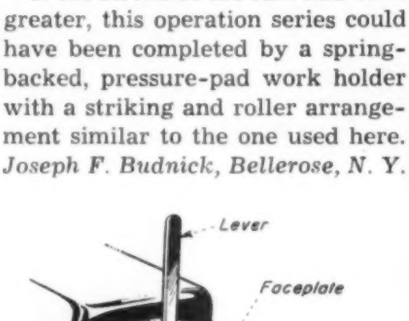
This cam-locking device should be used only where the press stroke is 2 in. or less. A conventional die-set is fitted with extra-long guide-post bearings. Two ram studs drive the floating punch-holding plate down on the work. The stroke punches a hole and marks the rod.

As the ram bottoms against the die, the cam lever attached to the back of the die is forced down by the slotted plate. This locks the floating plate in a down position.

As the ram rises, the retracting dog bracketed to the ram at the right contacts a ball bearing that drives a ball onto the rod end. Thus, the up-motion of the ram is employed.

When this is complete the lower edge of the slotted plate catches the locking cam and releases the floating punch.

If the stroke of the ram had been greater, this operation series could have been completed by a spring-backed, pressure-pad work holder with a striking and roller arrangement similar to the one used here. *Joseph F. Budnick, Bellerose, N. Y.*



Manual "Armbreaker" Turning Grooves Tube-Bending Forms

The recent article by R. E. Trospect on the machining of a wrist pin by manual turning is interesting, especially because tube-bending forms are even now made by that old and established, pre-Civil War method.

The forms are made from steel blocks. Grooves the size of the tubes to be bent are shaped on two straight edges, roughed out with a roundnose tool and finished with a circular tool. The radius at the end of the block is roughed to a scribed line on the shaper, and then the block is drilled at the center.

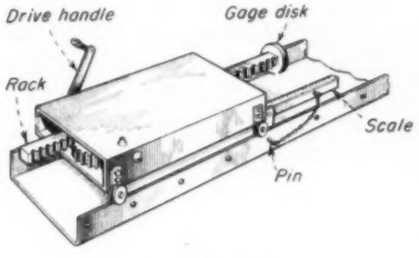
A mandrel is forced into the center hole and a dog locks the mandrel to the faceplate. A lever extension is added to a slot in the faceplate for turning. Final turning is done with a circular tool, set in the tool post, by turning the faceplate, mandrel and form by hand. A 180° stroke of the lever is followed by feeding in the tool for the next stroke.

The machinist who makes most of the forms in our shops walks with his left arm dragging behind him. *Frank J. Zarnowski, Rutherford, N. J.*

Chips in blind, tapped holes can be removed by holding a small magnet against a steel rod and inserting it in the hole. When the rod is drawn out the chips cling to it. *G. Shalkhauser, El Paso, Texas*

Job-Lot Chimney Bands Produced With Economical Tooling Methods

Making corsets for sky ticklers—known as reinforcing bands for tall chimneys outside the trade—involves shearing many sections of ⅜ by 3-, ⅜ by 3½-, and ½ by 4-in. strap iron into reasonably accurate lengths. Each complete band has three sections, and each band is a different length than each other band for the same chimney because of the taper in the structure. To gage the lengths I developed a device made from scrap parts.

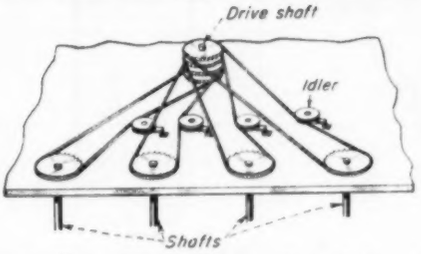


The base for the gage is a section of 12-in. channel iron with holes drilled through one flange at 1-ft. intervals. An old sausage stuffer rides on small wheels along the flange tops. The stuffer is essentially a rack with a stroke of just over a foot, driven by a gear train and a handle-operated worm.

A steel disk, mounted on the end of the rack, forms the gaging surface. An arm extending from the stuffer frame carries a 1-ft. scale that allows accurate location of the disk.

The stuffer is pinned to the channel at the next even foot over the desired length of band. This holds the stuffer solidly while the final setting is made by moving the disk by cranking the handle.

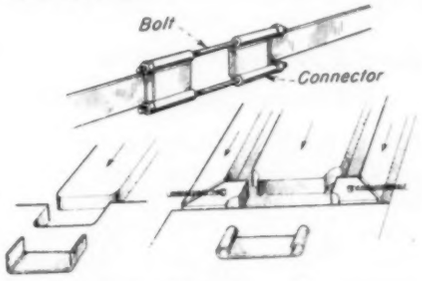
The three chimney-band sections are connected at two joints by countersunk bolts. To do the countersinking I rigged up a set of eight bicycle sprockets, driven from a motor reducer, to power four countersinking spindles. Four sprockets are mounted one above the other on the reducer shaft, above a large steel plate. The other sprockets are keyed to the work



spindles, spaced along the plate at the 3-in. distance required between holes in the ends of the mating bands.

Small idler wheels were added to the mechanism to keep the chain drives tight. Bands are clamped to the table under the plate and are raised to the countersinking tools by a foot lever.

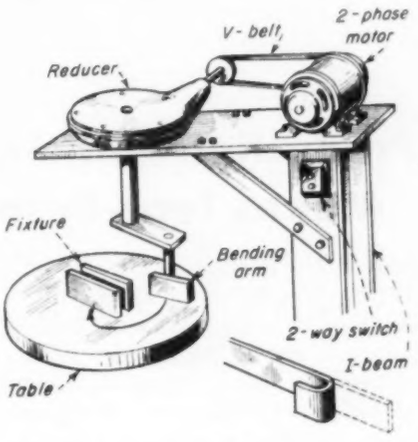
Each repair band that may be added later to a chimney to stop cracking includes one joint that can be taken up after the band is on the chimney. This joint is formed by bending the band end over a double-eye connector that carries two bolts. The complete joint includes two large bolts, two nuts and two connectors.



Some connectors are press-formed in a small bulldozer setup with a two-stage curling die. The first die presses strips of stock into U shapes; the second die curls the flaps over with a double action. The side rams force the flaps inward and the main ram presses them down and in to form the loops.

Bending the straps into an arc is done with an old wagon-tire bending machine—bought second-hand and powered by a motor and a speed reducer from a road grader. As the machine is adjustable, the varying amounts of bend required for corsets for different diameters of stacks is handled by changing the center distance between the rollers.

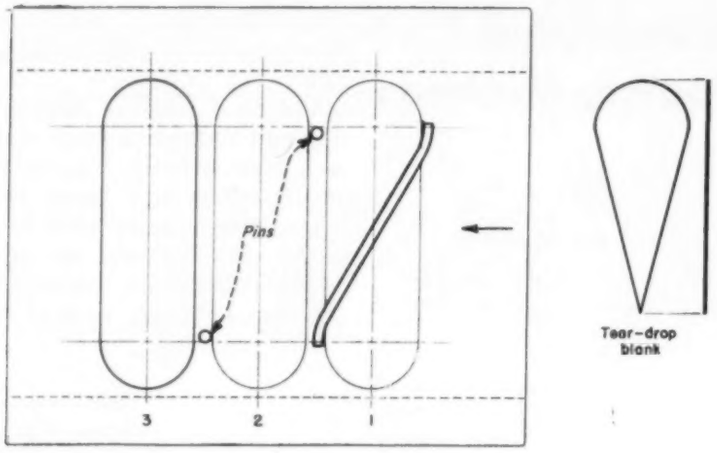
The band ends are U-bent by a different method. A plate on top of an I beam supports a 2-phase motor V-belted to a speed reducer taken from a scrap road scraper. Under the reducer, an arm of welded-steel straps rotates around the ends of two vertical plates



welded to a steel table. The flat end is set in this rough die with the tip projecting. As the motor runs, the bending arm revolves slowly to make the needed bend. The 2-phase motor is connected 3-phase with a 2-way switch so it can be reversed.

Another trick I worked out for the chimney-band corsets was to reduce wastage of paint from evaporation. The corsets are laid on the bottom of a large paint-dip tank and paint is pumped in from a storage drum until the paint line is about half way up the sides of the parts. Then the pump is switched to a hose line that is used to hand-spray the paint over the work.

Since the bottoms of the parts are immersed, only a small amount of spraying is necessary to cover the straps completely. Finally, the excess paint in the tank is pumped back into the drum until the next batch of straps is ready for finishing. This system prevents practically all evaporation that usually accompanies paint-dipping and saves both paint and solvent. *J. J. Reich, Reich-Huntington Iron Works, Huntington, W. Va.*



Production with Pre-Parting Punch Makes Tear-Drop Sheet-Metal Shape

Tear-drop shapes were being punched out of sheet metal with a single punch and die set. With a sharp corner on the die, the slightest bit of wear caused burrs to form on the blanks. Removing these burrs by hand grinding was anything but efficient, so a double-punch setup was developed to eliminate easily worn sharp corners and speed output.

A pre-parting line was punched in the first die position, followed by a final stroke in the second position that produced two blanks at once. The pre-parting punch was formed in a curved line that ran along the mating flat sides of two blanks and curved at both ends to blend into the final shape. The second punch was simply a solid piece that formed the rounded ends of the tear drops and also one straight side on each.

Stock was fed from right to left. The pre-punched slot located over two pin stops to position the stock for the second pierce. The operations were continuous along a strip of stock, the first and last strokes being positioned by hand.

Besides eliminating any chance of burr, this setup doubled the output and used 23% less stock than before. During setup the larger, second-position punch was bolted to the punch-plate through slots to make adjustment quick and easy. *Walter Gabriel, Albuquerque, N. M.*

Spiral Blade Silver Soldered in Standard Butt-Weld Machine

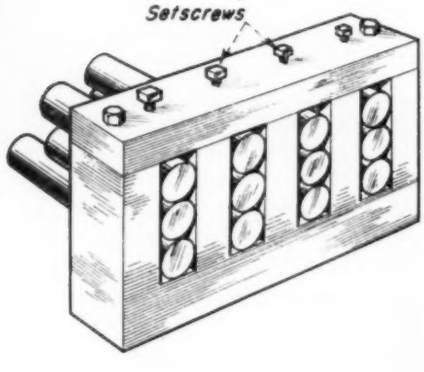
Spiral-tooth bandsaw blades, normally purchased in cut and joined loops, are really tough to weld together. However, they are originally joined by silver soldering, and if carefully done, the process can be applied to broken blades or for making shorter loops.

The job is done in a conventional type of butt-welding machine—that normally employed for welding standard blades together. The blade must first be scarfed on a grinding wheel. Because stock as small as the blade turns blue without warning, it should be dipped frequently during the grinding. Both ends must be ground straight and parallel to each other.

The ends are then clamped in the butt-welder jaws so they register in firm contact. The flux used is a creamy paste of borax and water. A solder with 50% silver with a balance of copper and zinc will melt at 1400° F, cherry-red temperature, and should do well.

Solder is wrapped around the joint—it should be as thin as possible—and the heating is started. The annealing temperature should be at "soft" and the control button should be jiggled for a while to drive out all moisture. Welding heat is not used. The heat is then taken up to annealing temperature until the blade gets red. It is held there by intermittent pressure on the button.

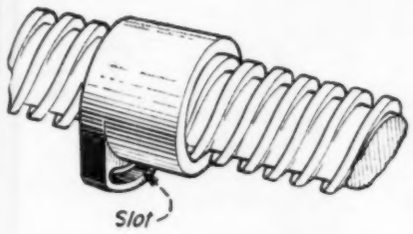
When the solder melts, it goes in a hurry. The temperature should be lowered gradually to anneal the blade and keep it strong. Solder may be left around the blade. This excess should be ground off. *Alexander Maxwell, Chicago, Ill.*



Hacksaw Fixture Clamps Bars

Solid stock, tubing and angle and channel shapes can be cut off quickly and safely in quantity in this hacksaw fixture, and without usual fouling from chips. It is clamped on the table of a power saw, stock is inserted in as many slots as can be filled, and the setscrews are turned down by wrench to hold the stock firmly.

The main block is made of steel, slotted and surfaced on a milling machine. The top bracket is bolted permanently in place, and all stock is pushed in from the rear. Heavy setscrews or any clamping device holds the stock. *J. J. Reich, Huntington, W. Va.*

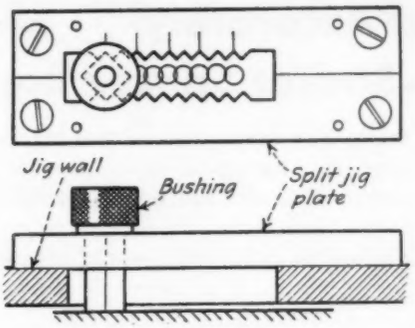


Auxiliary Machine Adjustment Finds Lost Shaper Motion

The vertical feedscrew and nut on a planer became so worn that it was practically unusable, so an auxiliary nut was added to the assembly.

The new nut was placed on the screw above the regular nut and turned down tight enough to prevent play but not enough to freeze the action. A hole was marked and drilled in the regular nut under the slot in the new nut to take a small capscrew. The slot in the new nut allows some adjustment after the capscrew has been put in place and for additional wear.

The new nut, being machined especially for the job, provides more accuracy without a loss of convenience. If the nut happens to be in a poor position for adjustment, a spacing washer can be drilled for the capscrew and added between the nuts. *Martin H. Ball, Watervliet, N. Y.*



Saw-Tooth Jig Aligns Drill For Machining Out Slots

We have recently adopted a system of drilling out slots with a bushing and jig plate arrangement to leave as little material as possible for later machining.

The jig plate is slotted with serrated edges to admit a drill bushing and hold it precisely in position. Manufacture was handled on a shaper, with the plate in two parts which were later matched. The drill bushings were shaped with square cross-sections in the portion below the top of the jig plate to match the serrations.

Slot drilling is started by drilling out alternate holes, spaced at every other pair of saw-toothed serrations. The holes in between are done later to prevent run-out of the drill. *H. Moore, Kirkstall, Leeds, England.*

HOLE DIAMETER	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	2	2 1/2
DRILL FEED	.003		.005		.007		.009		.014			.020		
SPINDLE SPEED C.I. & M.S.	1500	1060	794	547	385		298		207		146		110	
SPINDLE SPEED ROUGH STEEL	1060	547	385		207		146		110		78			
SPINDLE SPEED BRASS	1500				1060		794		547		385			
REAMING SPEED	146		110		78		55		42					

Plate Shows Feeds and Speeds

Machine-shop workers who operate drillpresses and radial drills will produce better results if a brass plate is fastened to the machine to indicate the best feeds and speeds for various materials.

The illustrated plate is an example of how such information can be presented to the operator. Although the illustrated speeds and feeds may be fast and require good cooling, they indicate how a plate was marked for one radial drill with 10 speeds and six feeds.

The chart is handier to a drill operator than a calculator and is more a permanent part of the machine after it is once placed in full view. *Donald P. Campbell, Cincinnati, O.*

$25 (in addition to regular payment) for the best PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

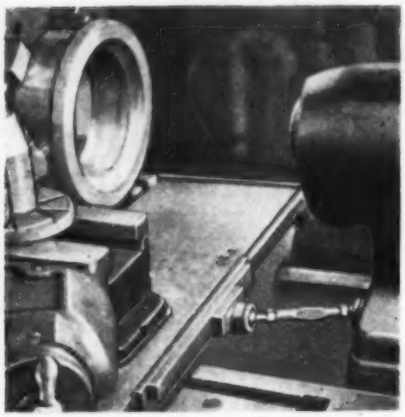
WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

59TH SELECTION

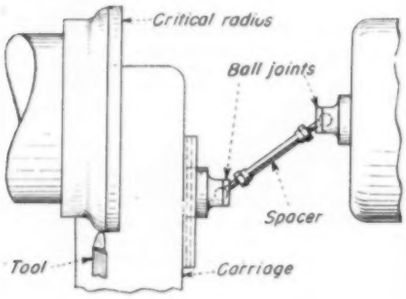
Clifford T. Bower's Automatic Dowel Turner,

Steam Fitting Turned Accurately With Ball-and-Socket Spacer Bar



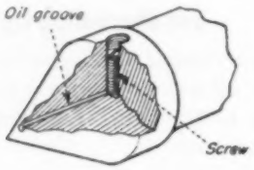
The steam-joint part illustrated was originally turned down by hand-operation of lathe feeds, and later by a forming tool, but neither method provided good results. The critical radius often required three hours of hand grinding before it was acceptable.

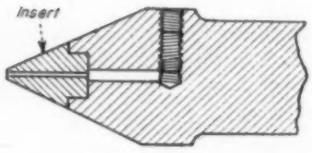
The difficulty was overcome by attaching a double-ball joint mechanism joining the clamp-down tailstock and the carriage. The tailstock end is bolted to the center of the tailstock face, and the other end of the rod fits in a T-slot that is parallel to the carriage. Each ball is held in its socket by a removable cover plate that was slipped on the rod before the ball was pressed onto the rod.



After the length and position were adjusted by turnbuckle and T-slot action, the work was chucked and indicated and the cross-slide moved into the work.

Since the carriage was loose, in-motion of the compound and tool was pivoted at the tailstock-ball joint. The radius turned was measured by the center-to-center distance between balls. The radius turned was accurate enough to require only a few minutes of clean-up grinding. *W. D. Stevens, Kingston, Ontario.*





Oil Flow Preserves Lathe Center

The life of a standard lathe center can be extended greatly if provision for flowing oil to the tip is made. As shown in the sketch, one way to do this is to drill a small hole from the tip, or close to the tip, back to a reservoir. The reservoir is drilled and tapped to take a headless screw through which pressure can be applied.

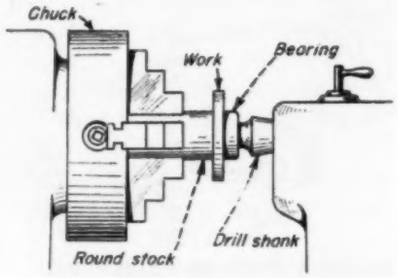
Another way to get the same result is to add an insert to the old center, with a small hole leading to the tip.

Ball Bearing and Drill Shank Clamp Disks in Thrust Setup

An old thrust ball bearing and a broken drill can solve the problem of turning flat circular disks that are too thin to grip easily by their edges.

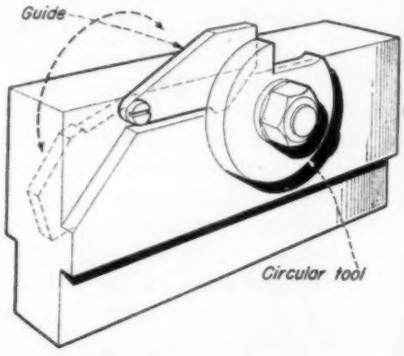
The drill is annealed, cut off and turned down to fit into the bearing race. This fit is not critical because it need be only tight enough to pull away from the work with the drill shank.

A length of round stock, smaller in diameter than the disks, is



chucked up and faced off flat on the end. With the bearing and shank mounted in the tailstock, as illustrated, the work is clamped between the bearing and stock.

Sufficient pressure to hold the work can be applied through the tailstock, and a fairly good-sized cut can be taken without making the disks slip. *George E. Caple, St. Joseph, Mich.*



Fixture Checks Form-Tool Grind

A small fixture, made in a number of sizes for different below-center distances, speeds and simplifies sharpening circular form tools.

The fixture is clamped in a vise on the grinder and the tool is bolted in place—positioned by the movable guide. The guide is employed as a templet for scribing the tool. After the tool has been ground down to approximate the right size, the guide can be flipped into place and the ground depth checked. The ground surface of the tool and the face of the guide can be compared periodically to check the progress of the grinding.

When the grinding is close to the final shape, the guide should be moved away from the wheel to prevent its being damaged by a deep cut, and only moved back for checking. *Bruce J. De Neve, Rochester, N. Y.*

NEWS OF METALWORKING

"Pool Orders" for Machine Tools To Fill Gap in Readiness Program

WASHINGTON — Pool orders for machine tools will be placed with the industry shortly by the National Security Resources Board and the Munitions Board. This means that the military high command is filling the final gaps in its industrial readiness campaign.

A pool order, handed out now for a specific list of products "if and when," needs only a telegram from the Reconstruction Finance Corp. stating the letter of intent number, to be put into effect at the outbreak of an emergency.

This latest action by the military agencies fills one of the last major gaps in the industrial "standby" plans now underway. The Munitions Board already has launched a series of surveys of about 11,000 industrial plants throughout the nation. Each survey will determine what products can be made in an emergency by a plant. When the survey and subsequent negotiations between the plant and a particular branch of the military are completed, the plant management is issued a "standby" order for a particular product or products. The contract might or might not contain a "target" number of units to be built at the outbreak of hostilities. The plant is thus "allocated" to one of the military agencies—Army, Navy or Air Force.

After the first 11,000 plants are surveyed, another 14,000 to 15,000 will be brought into the program, and at the end of this series, the military will have allocated the production of about 90% of American industrial capacity.

The gap in this program, however, is the machinery and machine tool industry, which was not scheduled for surveying. The NSRB "pool order" program will fill that gap.

The proceedings will work like this: plants which handled war orders last time will be approached on a pool order. Negotiations will work out the details of how much of what will be contained in the order. The size of the order will depend mainly on the company's ability to produce.

When the negotiations are complete, the standby pool order is ready to go. Should an emergency come along, a telegram from RFC would set it in motion. On the strength of that telegram the manufacturer can go to his bank and borrow up to 30% of the total value of the order. The order does not list a price, but specifies that the unit price will be that in the current catalog at the time of the go-ahead signal.

The NSRB expects that during the pool order negotiations from now on out there will be instances where some orders will be found impracticable. That trouble will then be thrashed out, eliminating just another set of bottlenecks which at the outbreak of hostilities would have caused a slow-down somewhere along the line.

Through this and the Munitions Board's "allocation plan," the M-Day planners hope to cut out about a year's time which otherwise would have been necessary to "take up the slack" in the military-industrial machine—as was the case in the 1941-43 period of World War II.

***HYDRAULIC PRESS** big enough to receive an entire automobile body and compress it into a bale of scrap 18 x 18 x 60 in. is shown in operation at the A-1 Iron & Metal Co. yard in Los Angeles. The press was built by Jack Gans, design engineer and head of the Hydraulic Press & Engineering Co., Los Angeles*

Free Speech Gets Backing of NLRB

WASHINGTON — Free speech by employers and unions was upheld by NLRB in two recent decisions.

NLRB ruled that Milan-Sparta Co., Sparta, Tenn., makers of shirts, had the right to announce in newspaper advertisements that it could close its plant any time for good business reasons and that unionization of the plant would ultimately lead to unemployment.

The statements were "apparently factually correct," the Board said, and were made in "reply to allegations by the union that the employer could not close its plant without violating the "Taft-Hartley law."

In the second case, NLRB refused to upset a union election victory at N. P. Nelso Iron Works, Clifton, N. J. It dismissed as pre-election propaganda a letter circulated by the Machinists Union referring to the employer as "a tough guy" and a "bully."

Steel "Technological Revolution" Seen Near With Advanced Methods

NEW YORK—Evidence is piling up that the steel industry is nearing a "technological revolution." The changes promised in steelmaking are so great that they have an important bearing not only on the industry, but on steel-users everywhere. For example, new production methods that promise to whittle down the huge investment needed for steel plants today may make it possible to widely decentralize the steel industry. And that would offset the possibility of major upsets in the competitive positions of steel users that was foreseen as a result of steel's change from basing points of f.o.b. mill pricing:

Among the new developments that have been announced are:

1. Proof that steel can be cast continuously in one simple step — rather than several expensive ones — from the liquid phase to semi-finished shapes. The process uses a new, special mold and has been developed by Republic Steel and the Babcock & Wilcox Tube Company. It is a major step forward after a century of research, has been claimed to be the biggest step in steelmaking since the turn of the century.

   Basically, the continuous casting method involves the use of a relatively inexpensive mold that accepts molten steel directly from the furnaces, forms billets, cools them, and then cuts them into lengths of up to 35 feet. The process eliminates hammering, pressing, rolling, and reheating operations and the expensive equipment they require.

   Because the process is still in the pilot plant stage, no final estimates are available as to how much it will increase production or will cut costs. But it seems certain that it will, by cutting down the heavy investment required to set up an integrated mill, make it possible for areas such as Seattle, Dallas, and New England to support their own steel-making capacity.

2. The use of oxygen by the ton in blast furnace operations may well increase production by 10% or more. At least three companies—Bethlehem Steel, Weirton, and Wheeling — are building plants to produce the oxygen on a scale large enough to operate furnaces. One of these, being built in Johnstown, Pa., by the Air Reduction Co. for Bethlehem, is expected to be in operation next month. More data on the experiment will be available then.

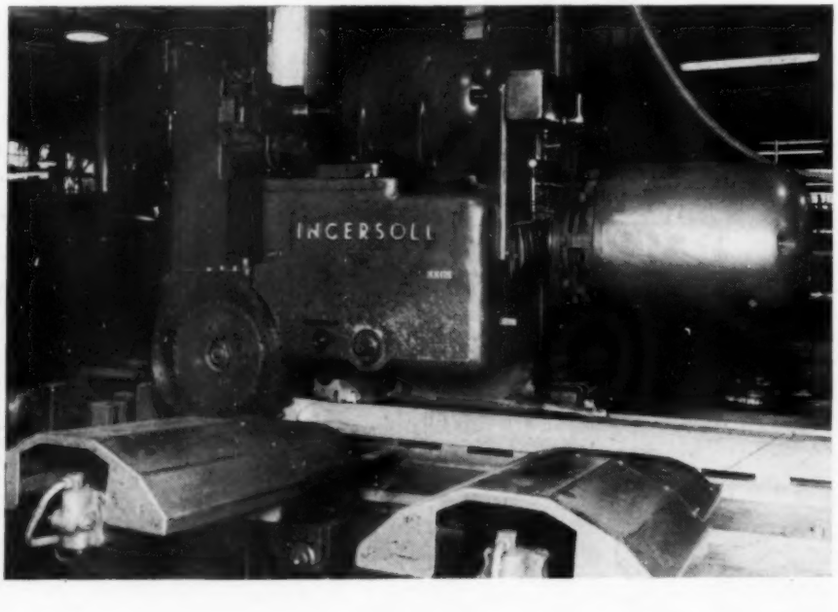
3. The possibility of increasing the nation's production of iron and steel by nearly 50% is claimed for Republic Steel's experiments with pressurized smelting in two converted blast furnaces at Youngstown and Cleveland. In this process, the furnaces are partly sealed by valves, instead of permitting the hot gases to escape directly into the air. This causes much higher pressures within the furnace, leads to higher temperatures in a shorter time, and so speeds the chemical reactions of smelting. Republic regards its experiments as so successful that it is equipping five other furnaces with the valves. Other companies are expected to adopt the technique.

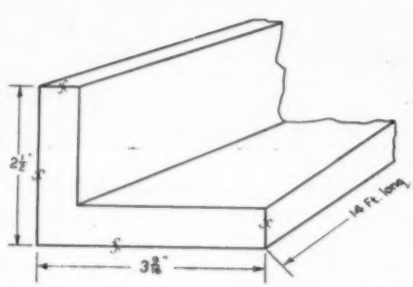
These developments, when finally proved in full production, promise to cut steel costs, expand production, and give decentralization of the industry a major boost. As yet, they are — particularly the continuous casting project — still largely experimental. But, along with the industry's search for new ore reserves, they may well mean that maps of the U.S.'s steel industry will be redrawn.

The seemingly inexhaustible beds of rich ore in the Lake Superior region are showing signs of exhaustion. As a result, the industry is extending exploration of new beds. In the Adirondack mountain region of upper New York state, for example, Republic, Jones & Laughlin Steel Company, and M. A. Hanna Company are operating mines that now produce well over 3% of the total iron ore mined in the U.S. That's more than five times the share of U.S. ore mined there 20 years ago and is indicative of the hunt for new sources.

Steel companies, too, are ranging Labrador, making preliminary exploration of vast ore reserves there. The possibility of using ores from other foreign countries is being considered.

In short, all these developments add up to one thing: the years-old rumors of new East Coast steel mills —and West Coast mills—may come true in the next few years. With the industry now on the brink of a revolution in production methods, steel buyers in every section of the country may well expect major changes in the industry that will affect them.





***HIGH-SPEED** carbide milling has replaced gang planing on long, narrow L-shaped cast iron beams and cost-saving has been high at the Whitin Machine Works, Whitinsville, Mass. A special Ingersoll machine is used, with a table speed of 168 in. per minute*

***SHEET-METAL WORKERS** are trained at a special school located at Fort Francis E. Warren, Cheyenne, Wyo., for Air Force maintenance teams. Instruction is divided into eight phases, of which only 15% is given in the classroom and the remainder in actual shop work*

Flood of New Orders for Merchant Ships Gives U. S. Shipyards Boost

WASHINGTON—The recent flood of orders for new merchant vessels—over $500 million in much-needed business for U.S. shipyards—means additional sales for the machine tool industry.

Current merchant and naval shipbuilding orders coupled with those contemplated in the near future run close to $1.5 billion. The Navy has on order from industrial yards: one anti-sub cruiser, four large destroyers, three high-speed submarines, two anti-sub submarines, and the flush-deck 65,000-ton super-carrier. Merchant contracts let on ocean-going vessels as of the beginning of August included 45 large tankers, eight medium tankers, one small tanker, two bulk ore carriers, one medium cargo ship, two small cargo ships, one hopper dredge, three $10-million round-the-world passenger ships, and two $25-million passenger liners to run between Mediterranean and U.S. ports.

In addition to ocean-going construction, there are under construction and on order 167 vessels of under 1,000 gross tons each, worth roughly $5 million, three trawlers and one 10,700-gross-ton hopper dredge.

Informal talks covering nearly $400-million-worth of future construction have already been initiated by the Maritime Commission. They include one $65-million super-passenger liner and four passenger-cargo ships for U.S. Lines, three passenger-cargo ships for Atlantic Gulf and West Indies Lines, 10 fast cargo ships for Black Diamond Steamship Co., and 20 large 20-knot tankers.

Bulk of the current contracts have gone to Bethlehem Sparrow's Point shipyards (22 tankers, one bulk carrier), Bethlehem Steel Shipbuilding Division, Quincy, Mass. (five tankers, two $25-million passenger ships), Sun Shipbuilding & Dry Dock Co. (13 tankers), Newport News Shipbuilding & Drydock Co. (11 tankers, plus the Navy's super-carrier), and American Shipbuilding Corp. (three $10-million round-the-world passenger ships).

Dutch Assembly Plant

AMSTERDAM (McGraw-Hill World News)—Kaiser Fraser expects to establish an assembly plant at Rotterdam late this year. With production for Dutch consumption and export, the factory will open with 400 workers. Capital will be $608,000 common and $532,000 preferred, with Kaiser Fraser investing $228,000 of this.

P. D. Reed CED Choice

NEW YORK—Philip D. Reed, chairman of the board of the General Electric Co., has been elected chairman of the Research and Policy Committee of the Committee for Economic Development.

Mr. Reed succeeds Raymond Rubicam whose term has expired.

Bank Helps Chile To Obtain Tools

WASHINGTON—The Export-Import Bank of Washington has just approved a credit of up to $375,000 to help Chilean industry. The credit is actually being granted Machine Affiliates, Inc., a New York corporation which acts as sole sales representative in Latin America for 19 machine tool builders in the United States.

Members include Cincinnati-Bickford Tool Co., Cleveland Automatic Machine Co., Elms Engineering Works, Gould & Eberhardt, Inc., G. A. Gray, Inc., Hanchett Mfg. Co., and Henry & Wright Mfg. Co.

Machine Affiliates will use the credit to help finance the sales of $650,000 general-purpose machine tools, cranes and foundry equipment to Manufacturera de Metales, S.A., Santiago, generally known as Mademsa, a manufacturer of copper products. The tools are to be used for general repair purposes and for the manufacture of special-purpose machine tools. Mechanics of the transaction are as follows: Export-Import Bank has agreed to purchase from Machine Affiliates obligations of Mademsa unconditionally guaranteed by the Bank of Chile in an amount not to exceed $375,000. The loan will be repayable in 14 quarterly instalments beginning Jan. 1, 1949, at rate of interest of 4½%.

Calendar

American Society of Tool Engineers—Semi-annual convention—Oct. 11-13—Los Angeles.

American Welding Society—Annual meeting—Oct. 24-29—Philadelphia.

National Instrument Conference and Exhibit—Sept. 13-17 — Philadelphia Convention Hall.

National Metal Congress and Exposition, American Society for Metals—Oct. 25-29—Philadelphia.

National Electronics Conference—Nov. 4-6—Edgewater Beach Hotel—Chicago.

National Plastics Exposition, Society of the Plastics Industry—Sept. 27-Oct. 1—Grand Central Palace, New York.

Packaging Machinery Manufacturers Institute—Annual Meeting—Oct. 12-13—New York.

Short-Run Economic Effects Seen Small in Steel's Pricing Change

NEW YORK—Delivered pricing systems used by a large part of American industry have been hit hard by two shocks—and doubt still surrounds some widely-used practices.

The first shock was a series of Supreme Court decisions that not only banned certain practices, but seemed to threaten many traditional pricing systems.

The second was the steel industry's abondonment of long-established basing points for an f.o.b. mill pricing system. This move seemed to threaten the competitive position of many companies.

Together the two raised two great questions for American industry:

1. Will a large part of America's industries—ranging from pulp and paper to road machinery, from liquefied gas to plywood—be forced to switch from delivered pricing systems to f.o.b. mill pricing to conform to new legal benchmarks?
2. Will the switch to f.o.b. pricing by steel, cement, and other industries disrupt and dislocate competitive standings of producers or consumers?

The McGraw-Hill Department of Economics analyzed the economics of pricing methods in the steel industry and surveyed leaders of the steel industry, steel-using companies, economists and a wide range of companies whose pricing practices may be affected by the legal changes.

The surveys showed the amount of concern aroused in business by the pricing developments. The surveys covered:

1. The economic effects of steel's switch to f.o.b. pricing.
2. The specific effects of steel's switch on steel-using industries.
3. The reaction to legal developments among leaders in various industries that use delivered price systems.

Concern Indicated

The degree of concern shown by business leaders is shown in the fact that several of those surveyed—including the president of one of the industry's largest steel companies—wrote letters of several pages to make their views clear.

Briefly, the results show that there is a large area of uncertainty as to what will happen to delivered price systems. And the long-range effects of the changes in pricing practices that have been made, which may be important to the entire U.S. economy, are not entirely clear.

But one hard fact emerges:

The immediate, short-run effects of the steel industry's change to f.o.b. pricing are small, economically. That was the concensus expressed by steel industry leaders, important steel users, and economists who were surveyed by McGraw-Hill. They reviewed McGraw - Hill's analysis, checked their own experience, and in general agreed. A few companies saw major effects immediately.

The reasons why steel's switch to f.o.b. pricing shows little in the way of immediate effects are:

1. Steelmakers can sell all their tonnage somewhere in these days of never-satisfied demand. So the steel industry itself saw no great, immediate change.
2. The pricing shift, in itself, changed prices on only 10% to 15% of all steel shipments. So the great majority of customers felt little or no reaction. And many of the customers who are now paying extra freight are located near their principal competitors. They are in the same boat, all paying extra freight. Then, too, in most cases any extra freight is less than 10% of the cost of steel, which itself may be no more than 10% of the cost of the finished product. Here, of course, we are talking about the effects of the change in pricing methods, not of the effects of the general price increase in steel.

There will be rare cases, of course, where a steel consumer pays extra freight and his luckier competitor does not, and where steel costs are a large part of the finished product's cost. There, competitive positions may be changed radically. But in only these rare cases will the pricing shift put a competitive disadvantage on steel consumers of more than 1% to 2% of their costs.

To get an accurate perspective on the reasons why the change has small effects in the short-run, we must take a look at three previous big changes in steel marketing methods. In themselves, these three changes help to explain a lot of the mysteries about basing point pricing systems.

Three Stages Toward F.O.B.

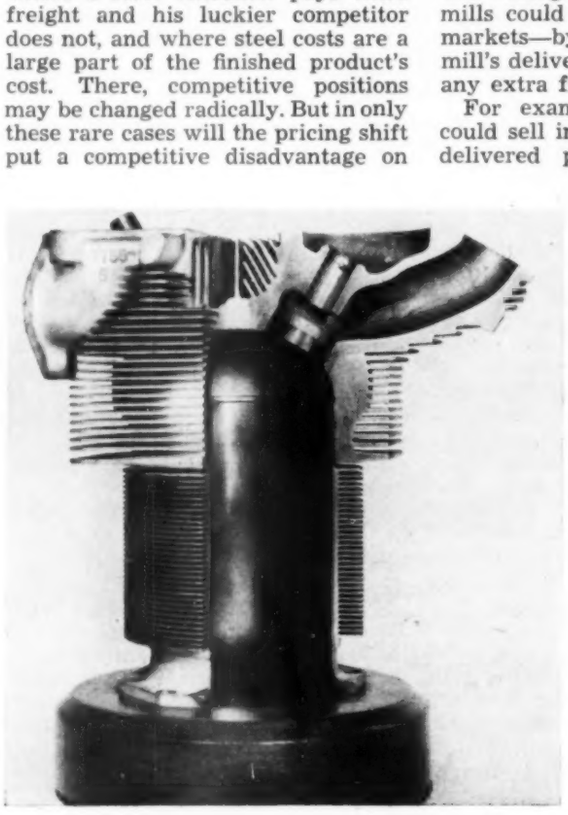
Before 1924, most of the industry sold on a "Pittsburgh plus" basis, a single basing point system. Had the switch to f.o.b. been made at that time, prices on almost all steel made outside Pittsburgh would have been affected. With less freight cost, Chicago steel could be delivered more cheaply in Milwaukee than under "Pittsburgh plus" prices.

Under FTC pressure, the industry changed its practice in 1924 and began to use several basing points, such as Chicago and Birmingham.

The second change came in 1938 when steel companies set up new basing points at many mills and started to price steel the same at most mills. Heart of the multiple basing point system is that the customer pays mill price plus freight from the nearest "base" mill. So the more "base" mills, the more customers there are who pay, in effect, an f.o.b. price—mill price plus freight. Thus, the 1938 move was another stage towards f.o.b. pricing.

But this change did not eliminate the basing point system. Different mills could still compete in various markets—by meeting the "base" mill's delivered prices and absorbing any extra freight charges.

For example, a Pittsburgh mill could sell in New York at the same delivered price as the Sparrows



***CUTAWAY** of cylinder assembly with aluminum fins bonded to the steel cylinder. Fairchild Engine & Airplane Corp. has licensed Wellworth Piston Rings, Ltd., Hampshire, England, to use this Al-Fin process*

Point mill, by absorbing the extra freight. A great deal of this sort of competition went on before the war with one mill supplying a customer in another mill's "natural" market.

Big Advantage

This was a big advantage to many producers when steel demand was low. Steel mills have a heavy fixed investment and large fixed charges. They also undergo big expense to set up equipment for rolling steel to customers' specifications. Hence, it often paid mills to absorb freight in order to pick up outlying business to maintain high and smooth levels of operations. As for consumers, most did not object to such a multiple-base-system under which they paid the same price no matter which competing producer supplied the steel. (Under "Pittsburgh plus", consumers far from Pittsburgh objected to paying "phantom" freight from there when steel came from nearby mills.)

Last change in steel marketing came about during and after the war when demand ran ahead of supply. Mills abandoned most of their shipments into others' territories and concentrated on supplying customers close to them, or in their natural markets at mill price plus freight.

The Pittsburgh-Youngstown district—including western Pennsylvania, eastern Ohio, and northern West Virginia and Kentucky—has 40% of U. S. ingot steel capacity. It does not consume that much steel. Contrariwise, Detroit auto plants use more steel than is made in Detroit; the same is true of the Atlantic seaboard. So the Pittsburgh-Youngstown supplies went west and east into other basing point markets.

So—when the steel industry shifted to f.o.b. pricing, the price that customers paid on the great bulk of the steel they bought was not affected. Most customers just went on paying what they had been paying—the mill price, plus the freight from the mill nearest them.

And even the great majority of the users buying the 10% to 15% of steel on which the pricing switch raised their costs will not have their competitive position affected. Much of this steel went to Detroit where most automakers are located. And even though the auto companies' practices in buying steel varied, they were affected in much the same way by the pricing shift. Furthermore, the cost of steel in itself is only 10%-12% of factory sales prices, so the shifts among the auto companies in competitive positions are minor.

In the same way, the competitive position of the customers who took the rest of the steel on which the the industry absorbed some freight—that part of the 10% to 15% that did not go to Detroit—were not affected a great deal. Take for example, a New York steel user. He probably

***ALAN R. CRIPE.** University of Cincinnati, won the First Scholarship Award of $1000 in the James F. Lincoln Arc Welding Foundation Engineering Undergraduate Award and Scholarship Program. Many other awards were made*

buys steel from both Pittsburgh and Sparrows Point, Maryland. Sparrows Point was the nearest base to him so he formerly got all his steel at the Sparrows Point base price, plus freight from Sparrows Point. The Pittsburgh mill absorbed $3.71 of extra freight per ton in order to keep his business.

But under f.o.b. pricing, he must pay that $3.71 a ton on the steel he gets from Pittsburgh. That adds about 5% to the cost of Pittsburgh steel to him. Now, if he is getting half of his steel from Pittsburgh, his overall steel cost is up only 2½% as a result of the change to f.o.b. pricing. Since steel is likely to be only 10% to 20% of the cost of his product, the pricing shift changes his overall costs by only one-quarter to one-half of one percent.

Here is one of the major sources of confusion coming from the pricing switch. The New York or California steel user has always had higher steel costs than did his Pittsburgh competitor. He was farther from the mill. The change to f.o.b. pricing did not cause the differential; at most it increased it only slightly.

Other Confusing Points

There are other confusing points. And everywhere there are special cases that seem to distort the picture. But the hard facts are:

1. Except for rare cases, the switch to f.o.b. pricing affected steel users' raw material costs by only a minor percentage.
2. The switch to f.o.b. pricing—from the customers' viewpoint—may prove to be no greater in its effects — and perhaps less, than either the 1924 or 1938 changes in marketing practices.
3. The general increase in steel costs—averaging around $9 a ton—that followed the switch to f.o.b. pricing meant far more in steel users' cost budgets than did the pricing change.

There are some companies and some industries that are importantly affected, of course. For example, an independent New York steel warehouse that bought all or a large part of its steel from Pittsburgh while its competitors were supplied by Sparrows Point. Under basing point pricing, the delivered price to both warehouse from either Pittsburgh or Sparrows Point was the same. But now the Pittsburgh-supplied warehouser must pay extra freight, and steel is his main cost, so he will be at a serious disadvantage. Already many steel buyers are trying to ship by truck the steel they take "free on board" at the mill.

Possible Hurdles

The conditions that might lead to trouble in the steel industry can be outlined:

1. If we should have another depression like that of the '30s in which steel operations should drop to 65% of capacity or less.
2. Pittsburgh - Youngstown, and other areas, still have a "surplus" of steelmaking capacity. In other words: their local markets would not be able to absorb more than, say, one half the steel they produced. And with today's high break-even points in the steel industry, that would be serious.
3. These surplus areas would try to export enough steel to places like Detroit to keep their mills going at a reasonable level of operations.

What may happen in the long-run, too, must be conditioned by legal decisions that are not yet made. This is true not only of steel, which makes a prime example for considering the effects of new ways in pricing, but for all other industries.

Even the trend of legal decisions is not yet clear. But McGraw-Hill's surveys of business' reaction to the recent series of cases, and the opinion of the Federal Trade Commission's experts, stress certain basic points.

The first is that F.T.C.'s major concern is to eliminate practices that restrict competition.

And the second is that it has two basic approaches. They were used—one, or the other, or both—in the recent important price cases. They are:

1. Is there "collusion"—a conspiracy to fix prices and so restrict competition
2. Is there "discrimination" in the pricing system that works an injury to competition — either among the sellers or among their customers?

Detroit

CHRYSLER STAMPING PLANT BEING BUILT...ORDERS FOR MACHINE TOOLS LET...TRANSMISSION WORK DUE

One of the quiet developments of recent weeks has been the start of construction on a new Chrysler Corp. stamping plant, located on Mound rd. at Nine Mile rd., midway between the Dodge truck division and the erstwhile Naval Ordnance plant now being operated as a parts making center by Ford Motor Co.

The company is silent on the program for this plant, but indications are that it will be employed largely to stamp out body sections for the adjoining Dodge truck facility. Conceivably some passenger car stampings will also be produced.

Equipment being ordered for the plant includes not only a most substantial complement of presses, but also some precision machinery required in tool and die work. Evidently the new factory may do a share of its own tool and die manufacturing. Some of the first deliveries of machines on order will begin to move into the plant in October, indictating that production may begin before the end of the year, in time for 1949 models.

***FIRST SIGHTSEER BUS** produced by Kenworth Motor Truck Corp., Seattle, was recently delivered to Rainier National Park Co. Seating 40 passengers, the bus has heat-resistant glass in large windows and skylights, plus a double ventilating system*

G. M. to be Late on Models

Chrysler and two General Motors divisions (Chevrolet and Pontiac) apparently will be among the last to unveil their 1949 offerings. The early part of the announcement parade, October or thereabouts, will be led by Nash among the independents, and Cadillac, as representative of the integrated companies.

Equipment is arriving rapidly at the recently completed plant of Harry Ferguson, Inc., on Detroit's west side. Manufacture and assembly of tractors will likely be under way within the next month or two. Ferguson is confronted, like other farm implement makers, with a most substantial bank of orders, even though its dealer organization was considerably impaired when Dearborn Motors Corp., successor to Ferguson as distributor of Ford tractors, absorbed most of the Ford rural car agencies which served as implement outlets.

Developments in automatic transmissions continue to intrigue the machine tool makers. On top of the potential business indicated by forthcoming erection of a new General Motors Transmission Division plant west of Detroit, other activities are beginning to come to light.

One such is the initial placements of business on the Packard transmission job. Another is the expectation of fairly early release for machine tools and other requirements for the Chevrolet automatic transmission program, which seems to be more and more assured for 1949 showing.

Also in the near-term cards is the Lincoln-Mercury development, worked out by Borg-Warner. Indications are that final approval of this transmission is a matter of days only, and once the go-ahead has been given, orders for tooling can be expected almost immediately. However, too much optimism on this score must be tempered by the fact that the project was once before at release stage, and was abruptly stopped practically in midair, after bugs were found in extended tests.

A potential automotive tooling customer is Crosley Motors, Inc., whose engine plant is being enlarged at Cincinnati. The program calls for facilities to make possible the output of 500 Cobra engines daily. These engines are finding uses in general industrial and packaged power applications, as well as in automobiles. Tests are also reportedly being made for aircraft applications.

Strike Still Felt

The prime automotive worry of August was the continuing strike of Campbell, Wyant & Cannon Foundry Co., at Muskegon. Lack of castings from this plant kept Hudson closed, and also punctuated production for limited periods at Ford truck, various Chrysler divisions, and other companies as well. The result was to slice back August output to approximately 475,000 cars and trucks; had the strike's effects not interposed themselves, volume would have been over 500,000 in all U. S. and Canadian plants for the second time since the end of the war.

One effect of the recent strike among Detroit tool and die shops has been a quickening of delivery promises, presumably because of work being withdrawn from the establishments during their shutdowns. Jigs and fixtures are now available on an average of less than four weeks, as contrasted with a full month or more in the spring. Sheet metal dies are available in four weeks, forging dies in a little more than five weeks; previously these figures averaged 4.3 and six weeks.

Payrolls Reduced

The unfortunate aftermath of the strike is further noted in study of employment figures in representative tool and die shops in the Detroit area. A typical group of 135 shops, comprising the largest as well as many of the smallest, had an aggregate payroll in August of 8,218 men, compared with 8,443 in the spring. Twelve shops—including some of the majors—had cut down their payrolls; nine had enlarged them, but none significantly.

In a general sense, Detroit employment was edging upward this summer. Seasonal activities seem to be expanding, stimulating factory hiring. The payroll totals would be definitely higher if it were not for the shutdowns created by shortages.

Names in the News

William T. Murden

Jack Curry, resident manager of New Departure, Meriden, Conn., plant, Division of General Motors Corp., has been transferred to the Sandusky, Ohio plant as resident manager. William T. Murden, of Bristol, assistant general sales manager, succeeds Mr. Curry.

Phillips B. White has been named manager of the Bond plant of the American Radiator & Standard Sanitary Corp., Buffalo, succeeding **Bernard T. Hain,** who resigned.

A. R. Kelso has been named executive vice president of the Federal Machine & Welder Co., Warren, Ohio.

Prof. Gregory J. Comstock has been named consultant by the Lake Erie Engineering Corp., Buffalo, in matters relating to powder metallurgy and the application of equipment.

W. J. Lundell has been appointed vice president and general manager of the Akron Brass Co., Inc., Wooster, Ohio, succeeding **H. Louis Stettler, Jr.,** who has joined the Elkhart Brass Co.

John F. Wilson has been appointed assistant general manager of the Pinspotter Division of the American Machine & Foundry Co., Buffalo.

Walter F. Perkins has been made vice president and general manager of the new Shops and Piston Ring Divisions, Koppers Co., Inc., Pittsburgh, and **Edward R. Hall** and **Lenvik Ylvisaker,** assistant general managers.

Conda P. Boggs has been elected president of Victor Electric Products, Inc., Cincinnati.

John Raleigh Swikard has been named plant manager of the Schaible Co., Cincinnati.

A. C. Monteith has been elected vice president in charge of engineering and research of the Westinghouse Electric Corp.

Robert L. Stubbs has been retained by Chambersburg Engineering Co., Chambersburg, Pa., originators of the Cecostamp.

Jacob J. Joachimi, formerly superintendent of manufacturing and tooling of the Bell Aircraft Co., has been appointed plant manager of the Buffalo Tool & Die Mfg. Co., Buffalo.

W. W. Sieg has been elected president of the Tital Metal Mfg. Co., Bellefonte, Pa., succeeding W. P. Sieg.

W. W. Sieg

Business Items

Fafnir Bearing Co., New Britain, Conn., has finished construction of a new warehouse and office, 245 Piedmont Ave., Atlanta, Ga. A. G. Laughridge is branch manager.

General Tire & Rubber Co. has acquired controlling interest in **Marquardt Aircraft Co.,** Venice, Calif., ramjet engine builders.

Rice & Adams Corp., Buffalo machinery firm, has been purchased by a group headed by Sidney G. Rose, Cincinnati.

S. & R. Tool Corp. has been formed in Miamisburg, Ohio, to design and furnish consultation services to manufacturers of machinery, machine tools and also to manufacture. Sidney Williams and Raymond Stephenson head the company.

Target Stamped Products Corp., Weirton, W. Va., have purchased a location for a new steel plant in Gustavus Township, Ohio. Construction will start immediately on one building with plans for three additional ones in the future.

Cutler-Hammer, Inc., Milwaukee, Wisc., electrical manufacturer, has expanded the Dallas district sales office and warehouse at 1331 Dragon Street, Dallas, Texas.

Air Reduction Sales Co. has appointed **Adelson-Wirts, Inc.,** Hartford, Conn., as a dealer of a complete welding line.

Eastern Cutter Corp., Newark, N. J., has been repurchased by A. R. Abeel, Sr., former president who again has become president. Mr. Abeel has also purchased the plant and assets of the L. T. S. Cutter Co., Newark. The other officers are Carl O. Abeel, plant manager; A. R. Abeel, Jr., sales manager, and Marion Florin, office manager.

Cyril Bath Co., Cleveland, machine tool and special machinery manufacturers, have acquired the Goodyear patents on roto forming in the United States, Canada and England. **Goodyear Aircraft** and the Bath company developed concurrently during the war machinery and methods for forming parts by stretching metals to their elastic limits and while under tension, upon a rotary moving table. The patents involved are subject to certain rights of the War Department.

Federal Machine & Welder Co., Warren, Ohio, has arranged to purchase the plant and facilities of the **Warren City Mfg. Co.** from the U.S. Navy.

New Idea Div., AVCO Mfg. Corp., Coldwater, Ohio, is constructing a new mechanized gray iron foundry that will have five times the capacity of the present foundry.

J. J. Topolinski, works manager of Skilsaw, Inc., makers of portable electric tools, has been elected vice president in charge of manufacturing.

Ray N. Morris

Roger M. Tarpy

Ray N. Morris & Co., Inc., West Hartford, Conn., has been reorganized as a sales and service organization, specializing in automatic and hand screw machines. The company is acting as distributor for Brown & Sharpe collets, feed fingers and other replacement parts and tools. Ray N. Morris is president and Roger M. Tarpy, vice president.

Brooks & Perkins, Inc., Detroit, has increased their plant by more than 100% with the purchase of property adjoining their present plant for fabricating magnesium.

F. J. Stokes Machine Co., Philadelphia, has enlarged and improved its facilities for producing punches and dies for industrial and pharmaceutical tablet machines.

Allen - Bradley Co., Milwaukee, Wisc., has moved their Northern Ohio district office to 4312 Carnegie Avenue, Cleveland.

Laeco, Inc., manufacturer of special machines and tools, Cleveland, has been purchased by M. O. Shepherd, former works manager of the **Bunell Machine & Tool Co.,** Cleveland. The name of the concern has been changed to **Shepherd Special Machine & Die Co.** Officers are M. O. Shepherd, president; Dan E. Shepherd, vice president, and Dick A. Shepherd, secretary.

Armco Steel Corp. has purchased **Jackson Tube Co., Inc.,** Piqua, Ohio, and is operating the plant as a tubing division.

Nice Ball Bearing Co., Philadelphia, is constructing a separate office building at 30th & Hunting Park Ave.

American Alloy Hard-Facing, Inc. has been incorporated in Cleveland and will engage in hard facing of valves, metal parts of machinery and earth-moving equipment. Stephen Krupienski is principal incorporator.

Eljer Co. of Ford City, Pa., has purchased the **H. B. Salter Mfg. Co.,** Marysville, Ohio, makers of plumbing fittings and valves.

Winter Bros. Stamping Co., Detroit, has purchased land in Napoleon, Ohio, and will erect a plant there.

The Stanley P. Rockwell Co., Hartford, Conn., has been named by the **Lanly Co.** of Cleveland as factory representative for industrial ovens.

Barber-Colman Co., Rockford, Ill., has appointed Paul Wichelhaus of the **Apex Machine Tool Supply Co.,** Charlotte, N. C. as exclusive distributor of hobbing machines and equipment.

Electric Auto-Lite Co., Toledo, Ohio, has purchased the **Wright Aeronautical** plant, Lockland, Ohio, from the War Assets Administration.

Simplytrol Products Co. has been formed in Cleveland to make under subcontract with **Assembly Products Co.** an automatic-controlling pyrometer. Carl R. Adrio is president.

Rapids-Standard Co., Inc., Grand Rapids, Mich., has adopted the trade name of Rapistan for all of its materials-handling equipment.

Linde Air Products Co. will build an oxygen distributing station and acetylene producing plant at Fargo, N. D.

John E. Shriver, former sales manager of the Avey Drilling Machine Co., has purchased and is operating the L & H Tool & Die Co., Inc., Covington, Ky.

Porter-Cable Machine Co., Syracuse, N. Y., have purchased the Unit Electric Tool Co., Syracuse.

Timken Roller Bearing Co., Gambrinus, Ohio, is now operating a new $80,000 acid-disposal plant which will treat 550,000 gallons of waste. Lime is used as a neutralizing agent and there is a 14-acre pond on which the treated acids are allowed to settle and evaporate.

Obituary

Neil C. Hurley, chairman of the board of Independent Pneumatic Tool Co., Aurora, Ill., died Aug. 2 at his home in River Forest. He was mainly responsible for the rapid expansion of the company for 21 years.

S. W. Rushmore, 77, inventor and automobile engineer, died Aug. 16 at his home in Plainfield, N. J. He patented a synchro-mesh gearing for autos and owned many other patents.

Bliss Charles Ames, 81, founder of the B. C. Ames Co., precision instrument and gage manufacturers, Waltham, Mass., died Aug. 18 in Newton, Mass. Mr. Ames began his apprenticeship in 1867, established his own company in 1901, and retired in 1923.

Mac Short, vice president of Lockheed Aircraft Co., Burbank, Calif., died Aug. 13. He was 51.

Raymond G. Haskins, 59, Chicago, died Aug. 17. He was president of the R. G. Haskins Co., electrical machinery manufacturers.

Louis E. Emerman, president of the Emerman Machinery Corp., Chicago, died recently.

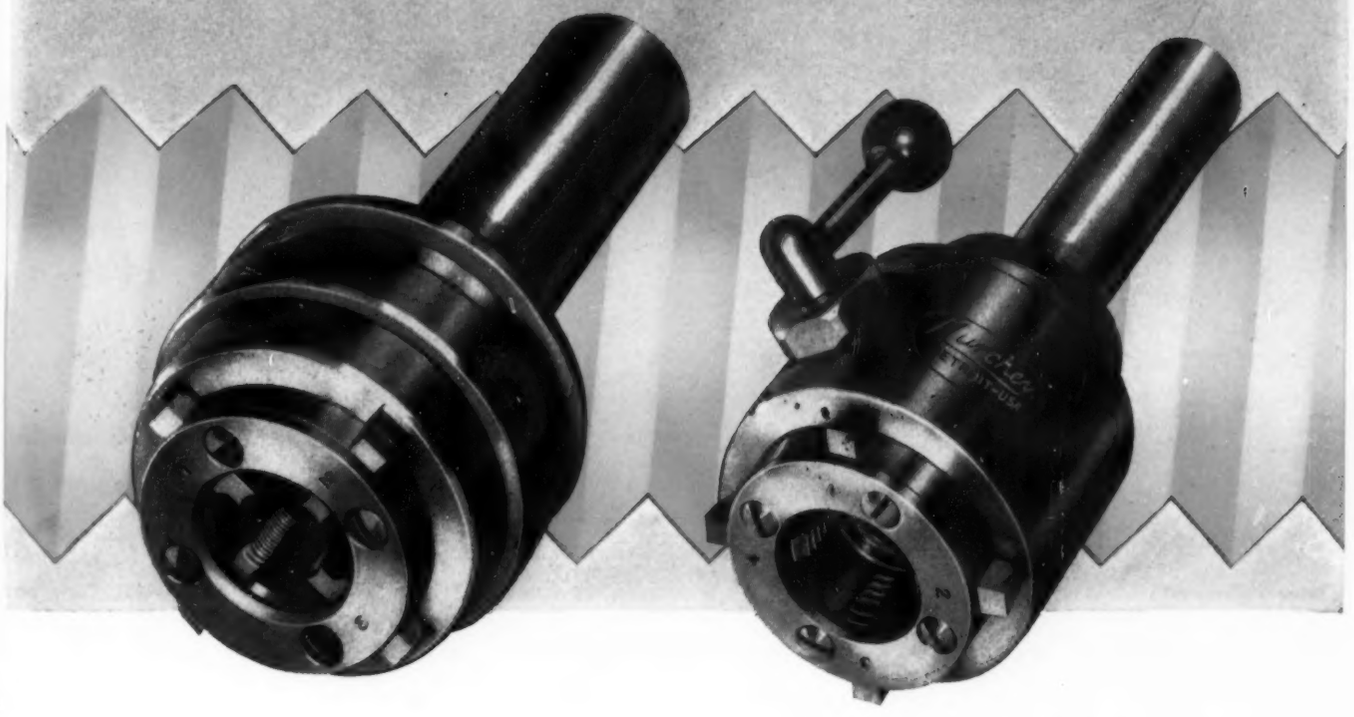
Howard J. Thompson, 60, chief chemist for the National Acme Co., Cleveland, died Aug. 22 in Wickliffe, Ohio. He had been associated with the company since 1917.

H. William Kopf, manager of the Detroit office of Pratt & Whitney, Division of Niles-Bement-Pond Co., Hartford, died Aug. 13. **Elmer E. White,** Milwaukee representative of the company, died July 21.

Wilbur C. Massow, assistant sales manager of Walsh Press & Die Co., division of American Gage & Machine Co., died July 26 in Chicago.

Lower cost per thread

WITH IMPROVED RADIAL CHASER DIE HEADS



THESE MURCHEY STANDARD DIE HEADS CUT THREADS IN SIZES FROM NO. 6 TO 6" IN DIAMETER

Larger sizes are available. Both are equipped with quick change chasers and snap action trip.

The "ORB" is used on automatic screw machines, drill presses or other machines which rotate the tool.

The "OLB" is a pull-off type self-opening unit for use on turret lathes, hand screw machines or other machines on which the tool remains stationary. It is ideal for short length threads or threading close to a shoulder because of a new trip adjustment. Size adjustment is controlled by a single nut at the forward end of the shank.

2934

The ease of handling

These tools and their simplicity of operation assure perfect threads at lowest cost. Ask for a demonstration in your own plant.

MURCHEY MACHINE & TOOL CO.

Lowest cost per thread . . .

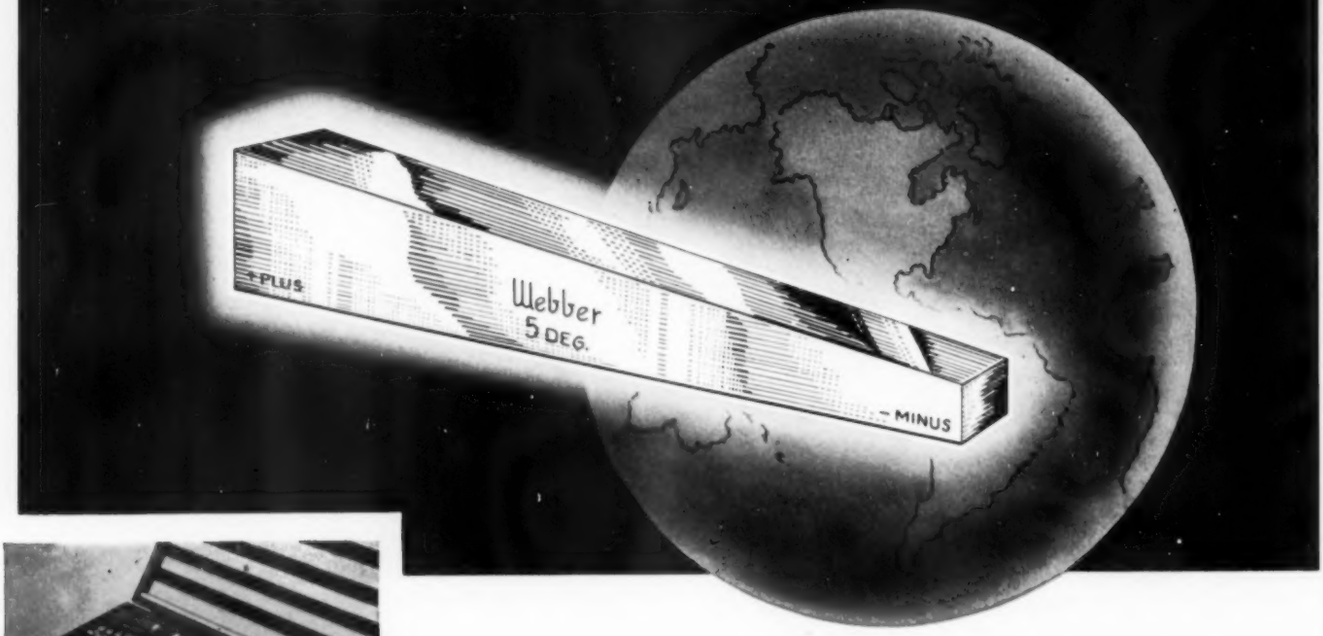
WITH MURCHEY TOOLS

MURCHEY

Manufacturers of collapsible taps, self-opening die heads (tangent and radial chaser types) and special threading tools

SUBSIDIARY OF THE SHEFFIELD CORP.
DAYTON 1, OHIO, U.S.A.

WEBBER ANGLE BLOCKS FAST BECOMING INTERNATIONAL STANDARD OF ANGLE MEASUREMENT



84B—84 block set (steel)
Accuracy: .000008....$235.00

Angle Gage Blocks increase speed and precision of angle inspection.

Recent reports from two international authorities indicate the imminent adoption of Webber blocks as a world wide yardstick for measuring angles.

Both authorities have made careful investigations of many aspects of angle block application and have noted the unparalleled accuracy and immense saving of time in routine measurement.

Webber Angle Blocks are demonstrating these advantages daily in scores of metal working plants. Not only is precision improved but new time-saving applications are being found daily. Write for Angle Block literature.

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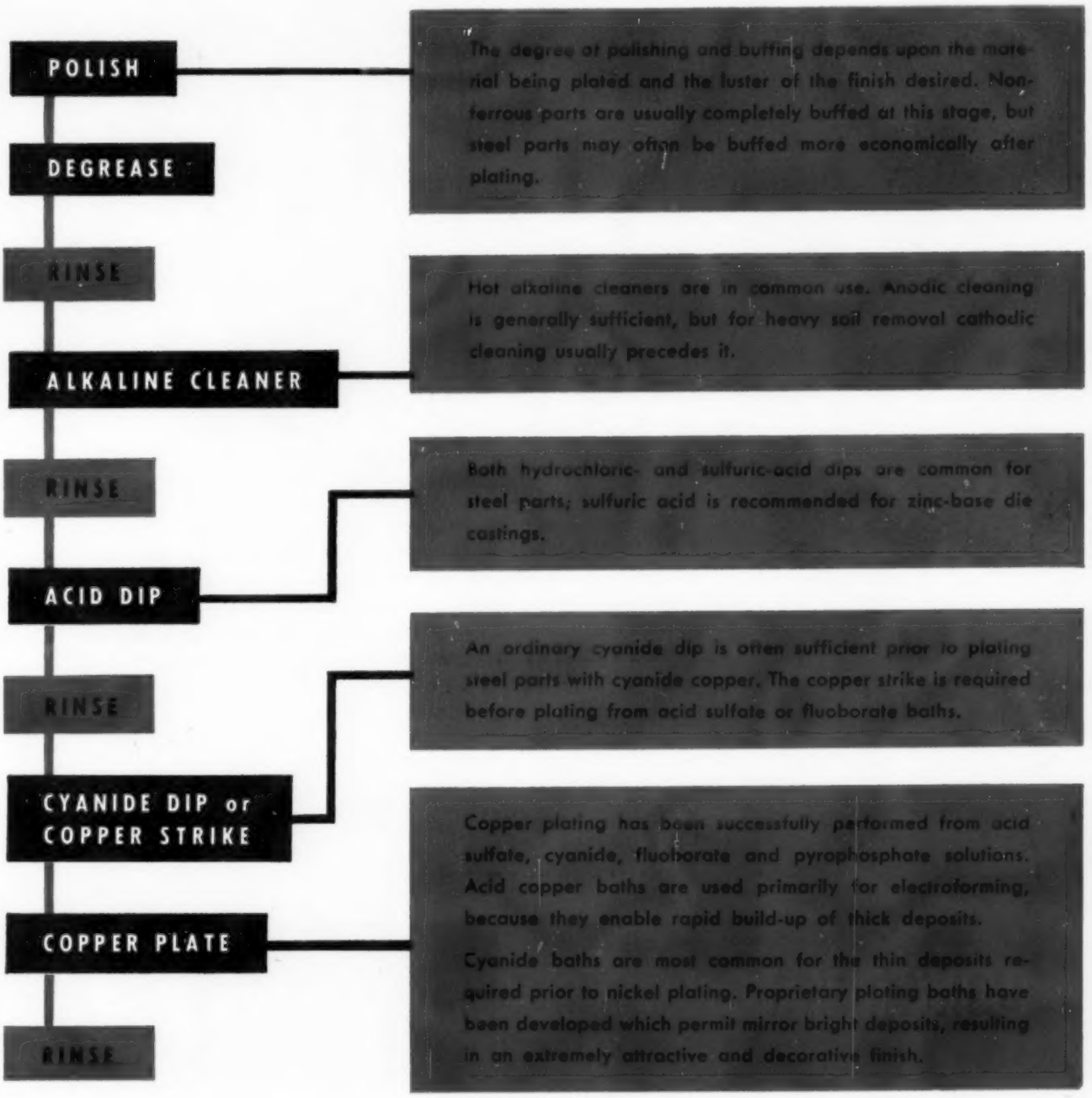
Transferring the extreme precision of gage blocks directly to the work without time taking precautions is one of the outstanding advantages of Webber Heavy Duty Gage Blocks and Fixtures.

Process Sheet For Copper Plating

BY GEORGE BLACK

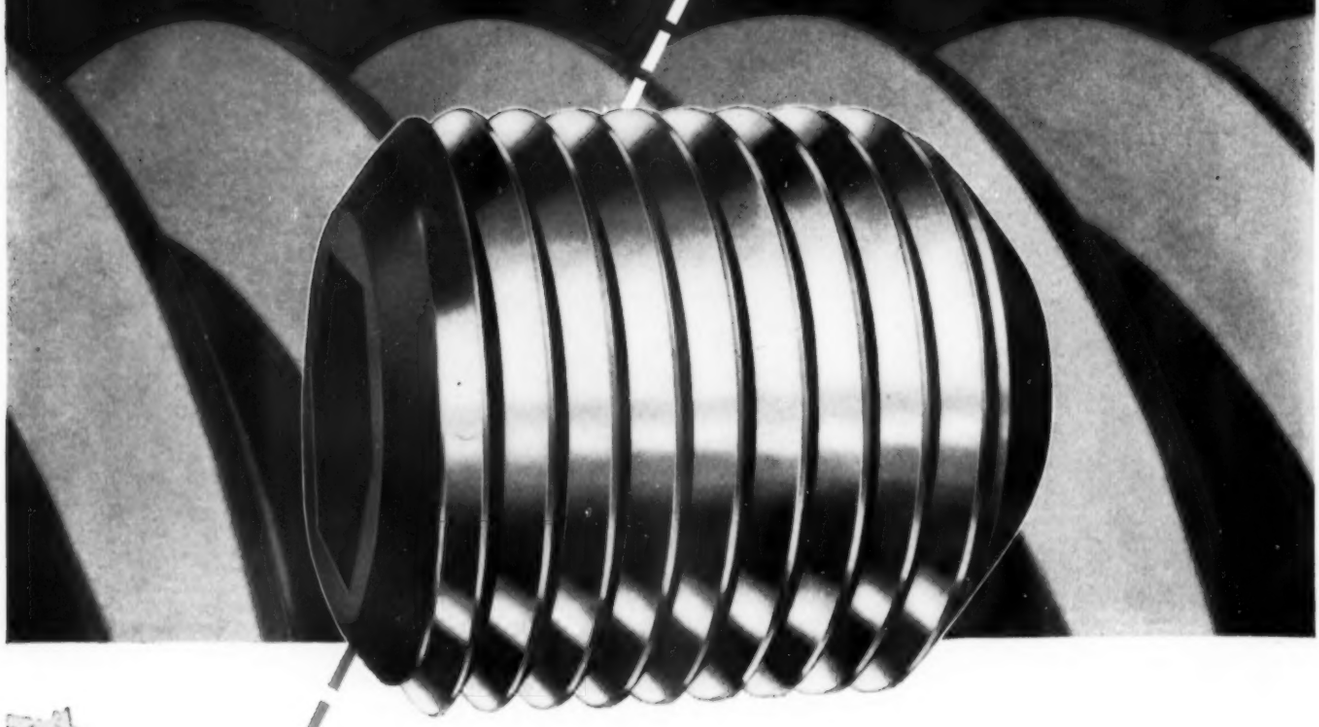
COPPER PLATING is used most widely as an undercoating on steel parts and zinc-base die castings prior to the deposition of nickel coatings. The excellent throwing power, high deposition rate and good adhesion achieved from commercial baths makes copper ideal for this application. In addition, the ease with which copper lends itself to polishing and buffing has been instrumental in cutting down the time required to secure a lustrous finish on steel surfaces. Copper deposits are also in wide use in electroforming applications, such as the making of electrotypes, records, screens and miscellaneous parts difficult to fabricate by common production methods.


POLISH
The degree of polishing and buffing depends upon the material being plated and the luster of the finish desired. Nonferrous parts are usually completely buffed at this stage, but steel parts may often be buffed more economically after plating.
DEGREASE
RINSE
ALKALINE CLEANER
Hot alkaline cleaners are in common use. Anodic cleaning is generally sufficient, but for heavy soil removal cathodic cleaning usually precedes it.
RINSE
ACID DIP
Both hydrochloric- and sulfuric-acid dips are common for steel parts; sulfuric acid is recommended for zinc-base die castings.
RINSE
CYANIDE DIP or COPPER STRIKE
An ordinary cyanide dip is often sufficient prior to plating steel parts with cyanide copper. The copper strike is required before plating from acid sulfate or fluoborate baths.
COPPER PLATE
Copper plating has been successfully performed from acid sulfate, cyanide, fluoborate and pyrophosphate solutions. Acid copper baths are used primarily for electroforming, because they enable rapid build-up of thick deposits.
Cyanide baths are most common for the thin deposits required prior to nickel plating. Proprietary plating baths have been developed which permit mirror bright deposits, resulting in an extremely attractive and decorative finish.
RINSE

You're O.K. with P-K for Dependable

CLASS 3 FIT

in GROUND THREAD Socket Set Screws



THE COMPARATOR, used in inspecting every lot of P-K Ground Thread Socket Set Screws, clearly shows why you can be sure of uniform, dependable Class 3 Fit. Threads are ground on hardened blanks, by the first successful quantity production thread grinding process, with many advantages offered first in Socket Set Screws by Parker-Kalon.

Free from hardening distortion, mirror smooth, they have none of the nicks, burrs and other imperfections common to cut threads.

SEE AND FEEL THE DIFFERENCE! Ask for samples. See why P-K Ground Thread Socket Set Screws are years ahead by every test . . . why they'll put your product out in front—assembly-wise and sales-wise. Parker-Kalon Corp., 200 Varick St., New York 14.

Available for Prompt Delivery

PARKER-KALON COLD-FORGED **SOCKET SCREWS**

SOLD ONLY BY ACCREDITED DISTRIBUTORS

FRICTION CIRCULAR SAWING

DATA COURTESY KLING BROTHERS ENGINEERING WORKS

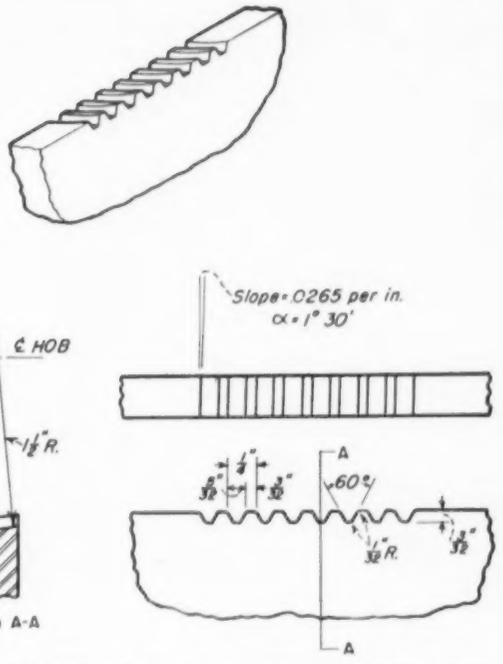
FRICTION sawing, known for at least 125 years, actually employs the heat of friction usefully. It concentrates heat on the material to be severed faster than the material can absorb it, so the contact surface becomes hot, hence less strong than the blade rim. Thus the blade removes the heated material readily, as "sparks" (actually minute chips torn loose), and cuts the material faster than any other process except shearing—with no loss of metal from the blade.

The friction saw is in a sense the direct opposite of the ordinary cutting tool or slow-speed saw. Consider a high-carbon steel lathe tool cutting against the rim of a slowly rotating steel disk. If the rim velocity of the disk is increased, a surafce speed is reached at which the tool will burn. By increasing the speed of the disk further, the tool will stop cutting the disk and the disk will start removing metal from the tool. Increasing the speed of the disk, still further allows it to cut easily through the tool by friction with little wear on the disk.

The cutting action has been reversed by an increase in speed of the disk beyond the critical speed at which the tool stops cutting the disk. Obviously, the cutting capacity of the lathe tool is limited by the critical speed, while the cutting capacity of the disk is limited to that speed zone between the critical speed and the speed at which the disk would burst. The safe operating-speed zone above the critical speed is so much greater than the zone below that a much faster rate of removing steel is possible with friction sawing than with any sawing method requiring an operating speed below the critical speed.

The process has been used for many years to cut varied structural shapes, in any sequence, without change of blade or setup. Thus far, it has been most effective on steels; cast iron breaks down before it loses tensile strength, hence cuts poorly. Non-ferrous metals tend to braze to the saw, causing loading.

Temperatures generated at the contact surface are higher than red heat, but below melting temperatures—about 1600 to 1800 F. Energy required to cut varies inversely as material temperature, being six times as great for 60 F. steel as for 1400 F. steel. Power and feed pressure



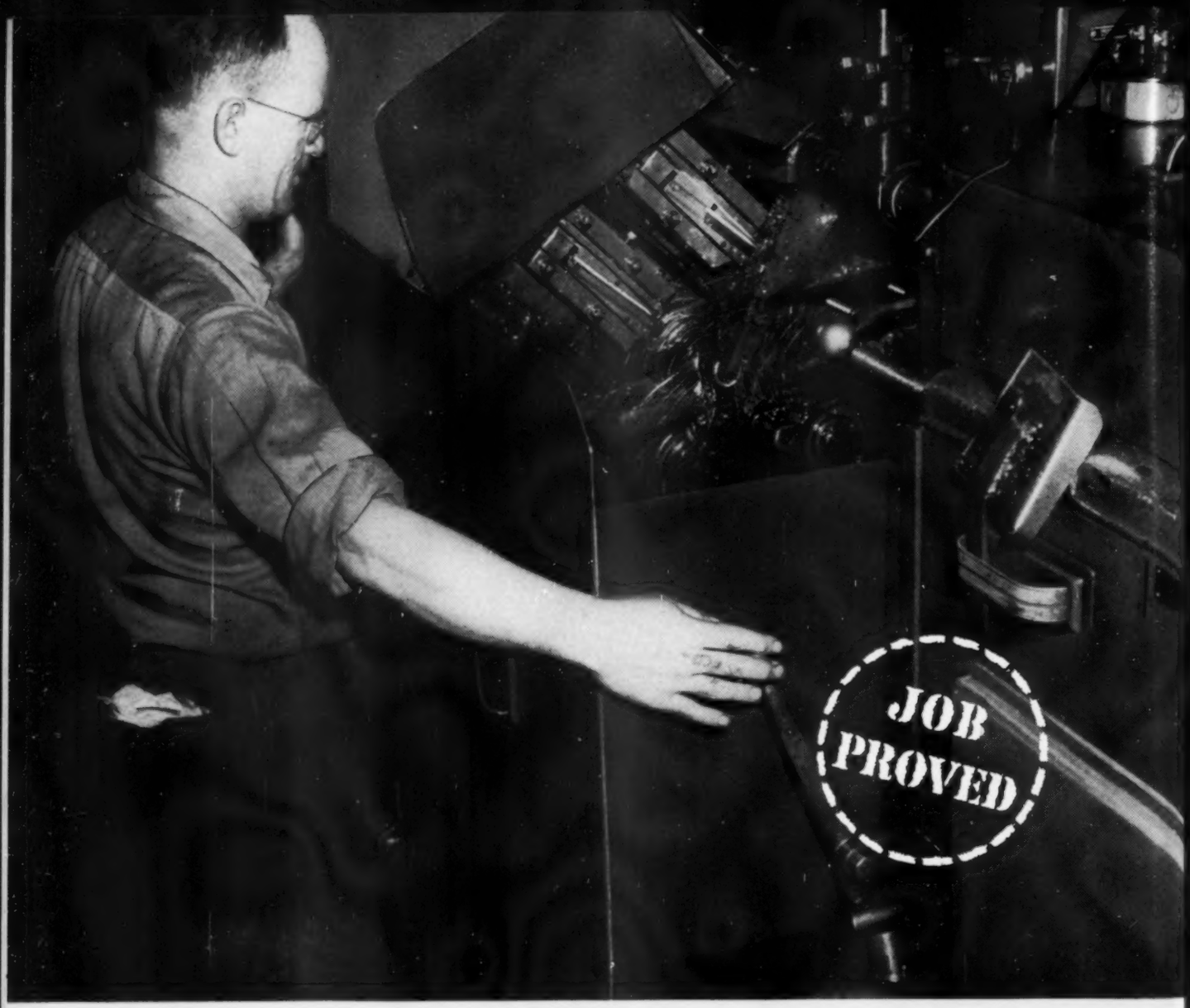
One hobbed-tooth form for cutting low-carbon steel. Total rim heating surface 37½% of periphery

Table I—Saws with Blade Pressure in Line with Stroke

Blade dia., in.	24	36	48
Rim thickness, in.	5/32	7/32	9/32
Blade speed, rpm.	3500	2375	1750
Motor load, hp.	25	50	75
Av. cutting time, sec., for COLD			
1-in. solid round	2	1.3	1
2-in. " "	9	6	5
3-in. " "	22	14	11
4-in. " "	——	27	22
5-in. " "	——	46*	38
6-in. " "	——	——	60
7-in. " "	——	——	92*

Hollow-ground, hobbed, average-sharp blade. Constant-speed motor, providing uniform blade velocity.

* Max. contact area for complete heat dissipation and no metal adherence to blade. Higher feed pressures permissible with shorter contact areas.



ONE OIL DOES TWO JOBS

One New Sunicut Grade with Petrofac* Replaces Two Oils, Gives Improved Performance and Lowers Costs

Part: Knurled rise nuts for Stillson wrenches
Operation: Spot, drill, knurl, and cut off
Machines: New Britain Model 61's
Materials: SAE X1112 and X1113 Bar Stock
Tools: Rex AA High-Speed Tool Steel
Cutting Speed: 156 S.F.P.M.
Cycle Time: 9.9 seconds
Production: 368 pieces per hour per machine

A manufacturer of wrenches was using two oils in his automatic screw machines—a dark cutting oil and a lubricating oil. Replacing both with one grade of new Sunicut with Petrofac, he found the way to many benefits. Savings have been substantial. Dilution of cutting oil through seepage is no longer possible. Drain-off from chips is increased. There is only one oil to buy, store and handle. Finish is better, tool life longer, work visibility improved.

Because the new Sunicut grades with Petrofac possess superior metal-wetting, antiweld and extreme-pressure qualities, they are giving outstanding performance throughout the metal working industry. They are not blended with animal or vegetable fatty oils—cannot turn rancid. For more information write for folder AM-9.

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SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

FRICTION CIRCULAR SAWING

required are directly proportional to area being sawed, because blade velocity must be constant while sufficient pressure is applied to generate heat faster than the material can absorb it.

Efficient rim speeds are from 20,000 rpm. for small blades to 28,000 rpm. for largest ones. At such speeds, the rim tends to stretch more than the center, so the rim will develop sidewise flutter unless rim tension is developed by peening both sides of the blade from center to within a few inches of the rim. Also cooling water is provided to strengthen blade life between dressings and reduce burr and cutting pressure. Usually, several streams at pressures up to 500 psi. are required to penetrate the air stream.

A properly cooled smooth-rim blade will cut continuously, even on hardened high-carbon steels, without any effect except almost immediate edge roughening, followed by slight rounding of the corners of the edge—which in turn produces greater burr on the cut pieces. Thus blades which cut carbon steels of 0.60 to 1.00% C are dressed after 8 to 10 hr. of cutting, the dressing merely being removal of the rounded corners, about 1/32 in. of the rim. On low-carbon steels, the blade rim tends to glaze smooth rather than to roughen. In any case, proper cooling is the essential element.

Rim shape—For cutting high-carbon steels, no peripheral toothing is necessary. For cutting low-carbon steels, however, early practice was to nick the blade with a cold chisel at ¼-in. intervals. This widened the edge sufficiently to give blade clearance, so hollow grinding was unnecessary. It may, however, develop excessive blade stresses, produce a wider kerf (requiring extra power), cause rough sawed surfaces and require a soft blade steel. More recent practice is to hob "teeth" (as sketched) in blades with not over 0.4% C. These must be hollow-ground, but do not edge-harden. Such blades are operated at 24,000-rpm. rim speed, and permit 3-in. length of contact for 24-in. dia., plus 2 in. for each foot additional saw diameter.

Special Blades—Tube saws of higher-carbon alloy steel, are hardened and have ground teeth like those on slow-speed saws, with slight positive front rake and varying top rake and length of land. Pitch is usually close, ¼ to 5/16 in.

Table II—Saws with Adjustable Horizontal Feed, Angle of Contact with Work Below Center

Blade dia., in.	24	46	48	56	58
Blade thickness, in.	5/32	1/4	9/32	3/8	3/8
Blade speed, rpm.	3500	1750	1750	1750	1750
Motor rated hp.	10	30	40	75	125
Av. Motor cutting hp.	13	39	52	97.5	162.5
Av. cutting time, sec., for:					
8-in. x 25.5-lb. I-beam	46	21.1	17.3	11.5	6.9
12-in. x 55-lb. I-beam	——	47.2	38.7	25.8	15.3
18-in. x 70-lb. I-beam	——	——	48.8	32.5	19.4
24-in. x 100-lb. I-beam	——	——	——	42.0	28.1
8-in. x 13.75-lb. channel	24.3	11.1	9.1	6.1	3.7
12-in. x 30-lb. channel	——	24.8	20.5	13.6	8.2
15 in. x 50-lb. channel	——	——	34.6	23.0	13.8

Av. motor load not over 130% rating, peak not over 200%, duty cycle not over 50% of total cycle time, constant-speed motor. Feed rate varies directly with blade pressure, motor load with change of pressure angle; thus raising work to horizontal center line reduces length of contact, motor load and blade pressure, raises efficiency.

They are limited to small sections with not over ¾ in. length of contact (longer contacts dull teeth rapidly).

Hot saws, which cut steel at red heat or higher, have teeth with 30° negative front and rear angle like those on a normal hobbed blade. Spacing is, however, ¾ in. or more and top surface is about 1/16 in. long—giving heating surface of only 8% of periphery. Such a blade is operated at 18,000 fpm. rim speed and must be cooled adequately to prevent buildup.

Cut Surface—Edges of friction-sawed pieces sustain shallow penetration (0.005 to 0.015 in. max.) of heat below the melting temperature. No hardness cracks are evident and grain structure is refined. Degree of surface hardness is dependent on carbon or alloy content. Constant-pressure saw feed causes variable depth of hardness which may complicate later machining if not annealed. Steels subject to heat checking are sometimes slow-cooled after sawing by burying in a heat-conducting material.

the grinding job

Automotive crankshaft grinding on a Landis Tool 16″ Type DH Hydraulic Crank Pin Grinder, rough and finish in one operation, direct from the lathe. SAE 1050 steel, Rockwell C 50-55. Stock removal .020″ from each sidewall, .040″ - .060″ on O.D.

the wheel

Borolon vitrified, A466-N6-V12, 42″ x 2¼″x 12″ . . . unexcelled for this work. Superior grinding for quality finish . . . high production . . . ability to hold corners . . . consistently duplicated on every wheel re-order.

Borolon ALUMINUM OXIDE *Electrolon* SILICON CARBIDE

SIMONDS ABRASIVE CO.

PHILADELPHIA, PA.

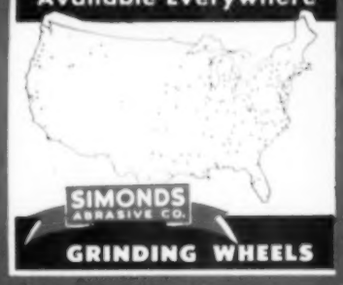
Crankshaft Grinding Wheels

New . . . recently developed . . . Simonds Abrasive V12 Bond . . . exceptionally efficient for crankshaft grinding . . . proved by continuous use by many of the top crankshaft grinding accounts . . . also a standard in the regrinding trade.

Standard specifications:

Roughing	**A366-N6-V12**
Rough and Finish	**A466-N6-V12**
Finishing	**A60 -P5-V12**

Available Everywhere



where to get it

Simonds Abrasive Engineers working through Simonds Abrasive Distributors in all principal U. S. industrial centers have the experience and production "know how" to advise on grinding wheel selection for your specialized production. Complete details on request.

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Philadelphia, Pa.
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SIMONDS ABRASIVE COMPANY
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Quality control has characterized Simonds Abrasive Company products during more than 50 years as a major manufacturer of grinding wheels and abrasive products exclusively. This control begins with the abrasive grain produced in modern electric furnaces by Simonds Canada Abrasive Co., Ltd., and extends to the finished wheels for all types of grinding from roughing to precision finishing. This means consistently high wheel performance—long lasting action, that boosts production, cuts grinding costs.

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Shop Equipment News

Brown & Sharpe Adds 5-hp. Plain, Universal Millers

Universal and plain milling machines are offered by Brown & Sharpe Mfg. Co., Providence 1, R.I. Designed to take heavier cuts than the Brown & Sharpe light types, the milling machines have an increased vertical capacity, a No. 50 milling-machine standard-taper hole in the spindle, spindle speeds for larger cutters, and rigidity to permit using the greater power.

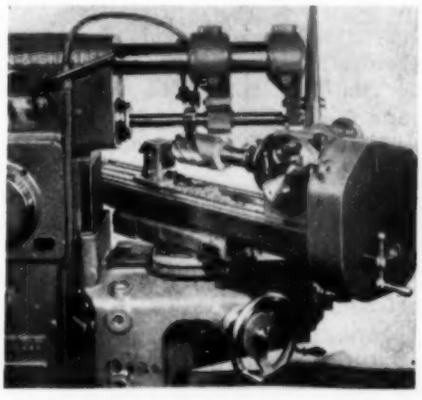
A 5-hp. all-gear drive is provided to cutters. The cutting feed and fast travel are driven by a ¾-hp. motor synchronized with the spindle motor. Fast travel of 75 ipm. in all directions is available with the spindle rotating or stopped. A single lever selects any of the 18 spindle speeds from 30 to 1200 rpm.

A lever selects any of the 18 cutting speeds in the range of ½ to 20¼ ipm. The coolant system is operated by a ¼-hp. motor-driven centrifugal pump which automatically stops when the spindle stops. Automatic lubrication is provided for column, knee, table saddle, and slide.

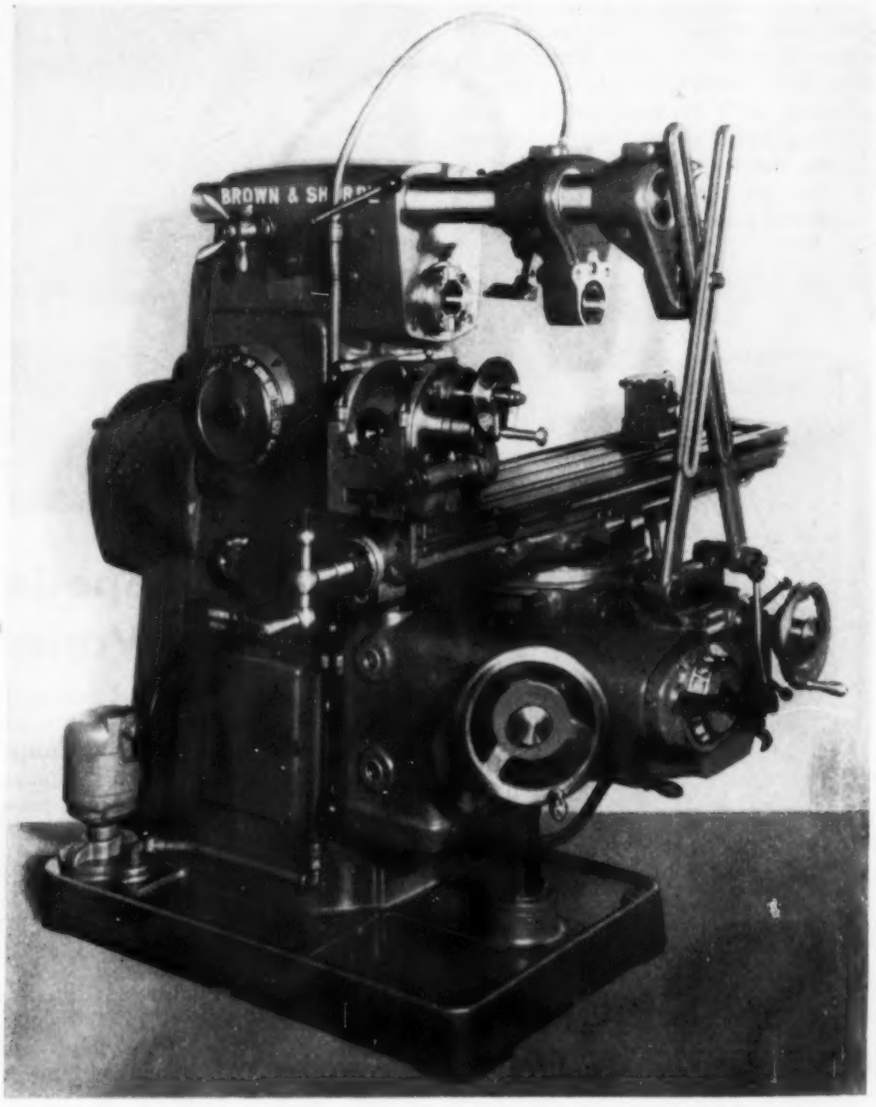
The machines offer the extended-spindle-face design with the spindle nose extending forward more than 3 in. from conventional position. This brings the front-spindle bearing nearer the center of the table, reducing overarm and arbor lengths. The universal and plain machines have a longitudinal feed of 28 in., transverse feed of 10 in., and vertical feed of 16½ in.

The arbor support is said to often permit the use of smaller arbors and smaller diameter cutters (which are less expensive). Smaller cutters give greater production for they feed faster at the same surface finish and require shorter run in.

When attachments are used on the extended spindle face of the 5-hp. machines, greater rigidity is secured with no loss of throat distance. The largest cutter which can be handled with the overarms is 12⅜ in dia.



The extended-spindle face permits cutting closer to the spindle nose with a considerable swing of the table



The No. 2 Universal milling machine offers a 5-hp. motor for the spindle

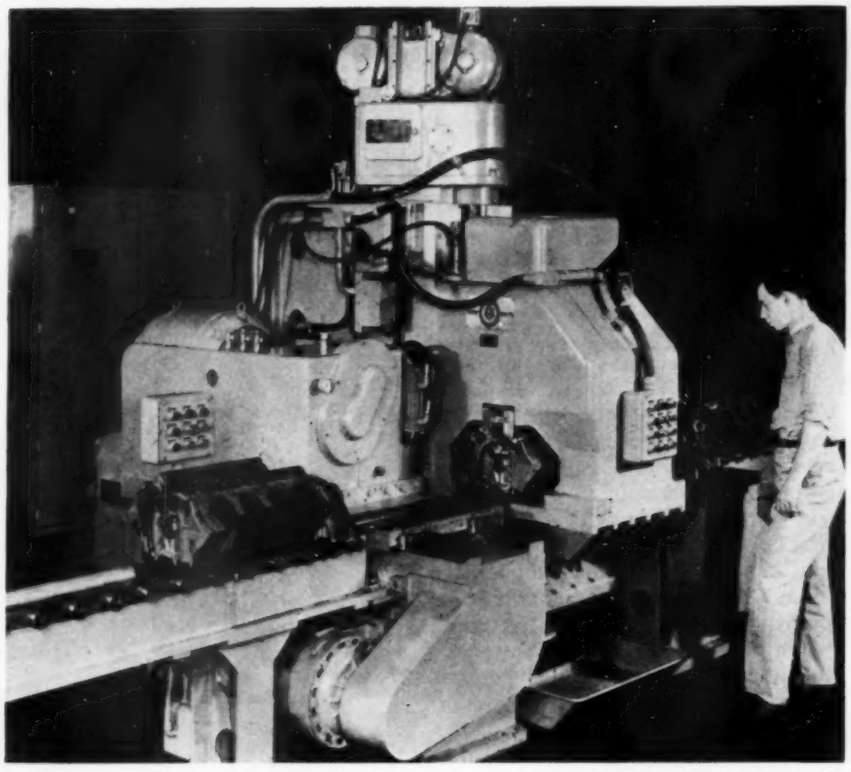
FLEXIBLE-SHAFT MACHINES are made by Stow Mfg. Co., Binghamton, N. Y. Known as Lightnings, the light-duty machines are adaptable for use in repair shops and in welding and sheet-metal work. The line of machines comprises both ¼-hp. and ½-hp. 110-v., ac. 60-cycle, single-phase motors, with speeds of 1725 and 3450 rpm., mounted on a high pedestal. Both size motors are equipped with either 5- or 6-ft. flexible shafts. Shafts can drive buffers, grinders, polishers, sanders, drills or wire brushes. Ball-bearing motor connections and hand-pieces assure trouble-free operation. A tray on the base accommodates hand and power tools used on the job

Automatic Thickness Measurement Taken with Photocon Metroscope

An ultrasonic device called the Metroscope is offered by Photocon Research Products, 1062 N. Allen Ave., Pasadena 7, Calif. The Metroscope automatically measures the wall thickness of metal, plastic, and glass parts where only one surface is accessible, and also makes non-destructive tests to detect flaws and imperfections in these materials. It is said to be able to measure the wall thickness of a long tube, with less than two percent error.

The Metroscope employs an electronic oscillator to generate electrical voltage, the frequency of which is varied throughout the tuning range. The point or points in this tuning range at which the part resonates are indicated. Since resonant-frequency and thickness of part are related for any given material, it is possible to calibrate the Metroscope to read thicknesses directly. Thickness of tubes and flat parts between 0.015 and 0.300 in. can be read directly, and up to several inches can be read indirectly.

The resonance indications also give information about flaws in solid parts. Steel, brass, nickel, copper, silver, aluminum, magnesium and lead, as well as glass and plastic, can be measured by the Metroscope.



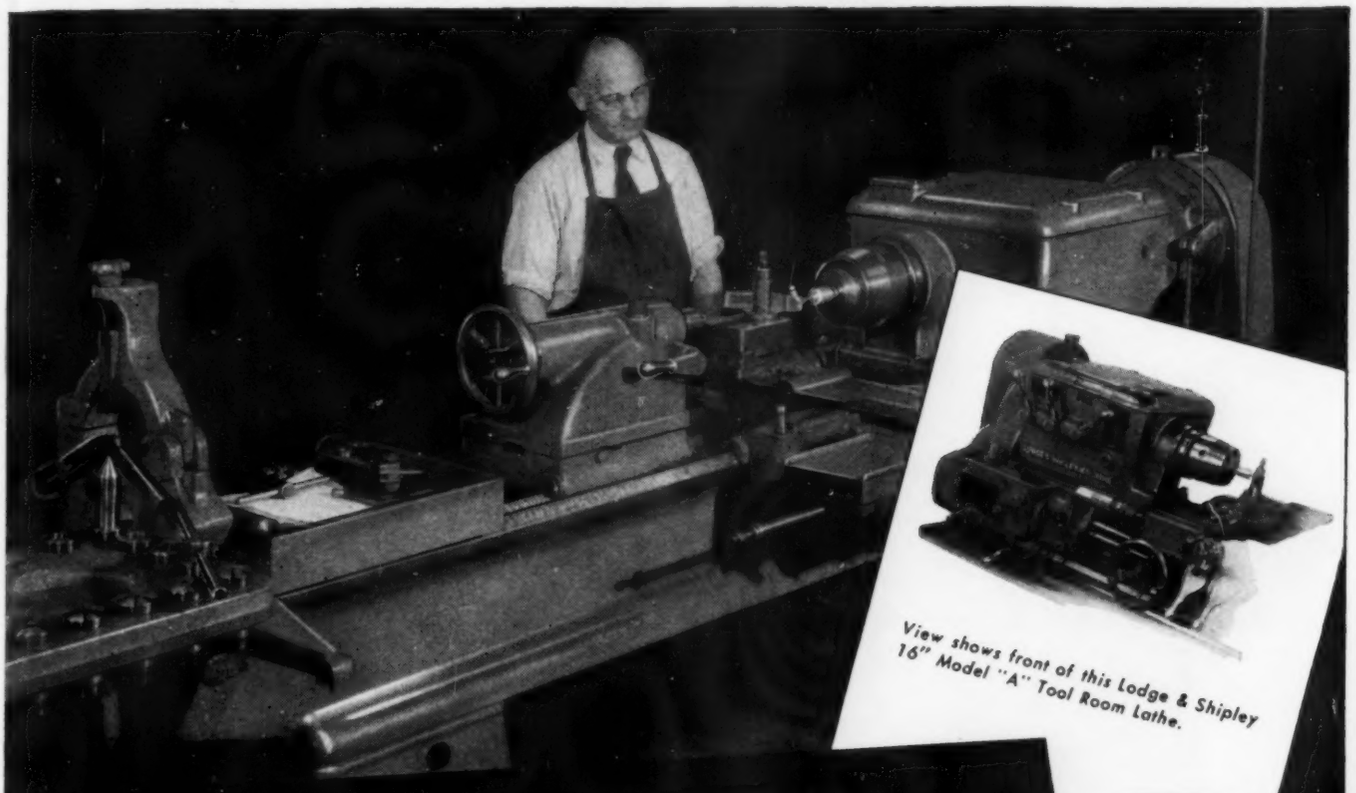
Sundstrand Special Rigidmil Machine Combines Varied Milling Operations

A special Rigidmil designed and built by Sundstrand Machine Tool Co., of Rockford, Ill., automatically mills both ends and the main-bearing faces of an automotive cylinder block with a single clamping of the work. The two 15-hp. horizontal, single-spindle heads have transverse feed on slideways at both ends of a rise and fall fixture to face-mill the ends of the block.

A 7½-hp. head mounted in the machine base drives an arbor with cutters for straddle-milling the main bearings. The conveyor-fed block enters loading position on a hydraulically-operated shuttle. The cycle is automatic and pushbutton controlled.

The block is shuttled into the rise and fall fixture where it is hydraulically clamped. The two opposed horizontal heads feed simultaneously to face-mill both ends of the block. At the end of the stroke, the cutters retract and heads rapid return. The fixture then feeds downward for the straddle-mill operation on the main-bearing faces. When completed, the fixture rises, releasing clamping pressure and ending the cycle. The finished block is then shuttled out the opposite side of the fixture as another rough block enters.

Noted air conditioning manufacturer checks 3 year record of Lodge & Shipley lathes



View shows front of this Lodge & Shipley 16" Model "A" Tool Room Lathe.

"IN FIRST CLASS CONDITION... DOING AN EXCELLENT JOB" SAYS CARRIER CORP.

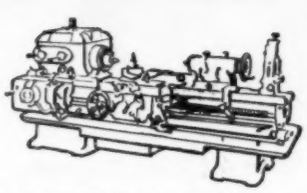
Carrier

"Lodge & Shipley Lathes cut time 40%" according to the records of the Carrier Corporation. And, after three years service in the plant of this noted air conditioning and refrigeration manufacturer, Lodge & Shipley Lathes "are in first class condition . . . doing an excellent job."

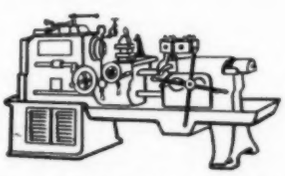
In the illustration above, a Lodge & Shipley Model "A" 16" Tool Room Lathe is turning a die part in the Carrier Syracuse, N. Y. plant. This lathe, used on the production of jigs, fixtures, dies and miscellaneous tools is rugged enough for the toughest possible range of work . . . yet accurate and dependable.

Specifically designed to cut time and cost . . . Lodge & Shipley Tool Room Lathes offer fifty-five instantly selected feeds . . . ranging from fine feeds to coarse hogging cuts.

You too, will find Lodge & Shipley Lathes ideal for a wide variety of superior lathe work in record time. See your nearby Lodge & Shipley representative for details of how Lodge & Shipley Lathes can save you hours and dollars. Write for condensed Catalog showing the complete line.



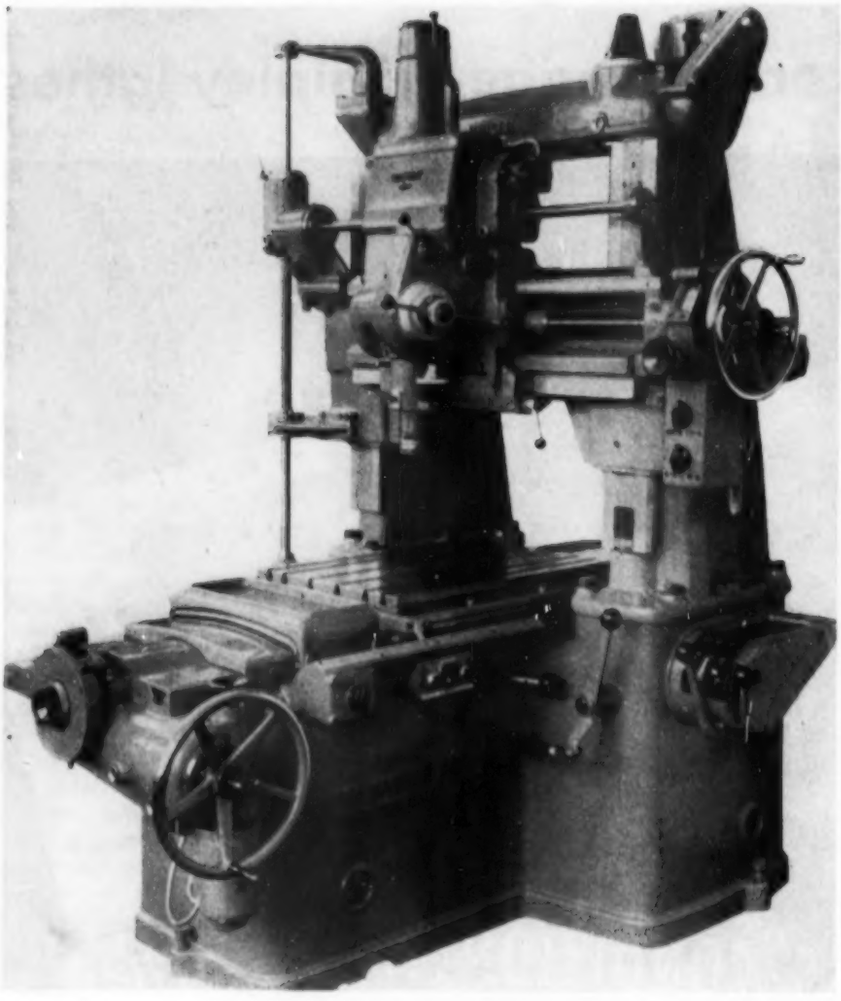
Lodge & Shipley Engine, Toolmaker, Manufacturing, Hollow Spindle and Gap Lathes.



Lodge & Shipley Acme Turret Lathes in Way-type, Ram-type and Saddle-type Models.

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

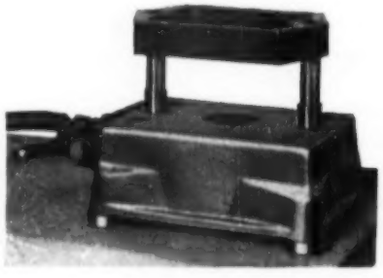


Hauser No. 4 Jig-Boring Machine Incorporates a 24x16-in. Capacity

Hauser Machine Tool Corp., Manhasset, N. Y., introduces the No. 4 jig-boring machine with a 24x16-in. capacity. The maximum drilling capacity is 1¼ in.; maximum boring capacity is 6 in. Direct readings on verniers can be had to 0.0001 in. Accuracy of slide location is 0.0002 in. The standard range of the nine spindle speeds is from 68 to 2,000 rpm.

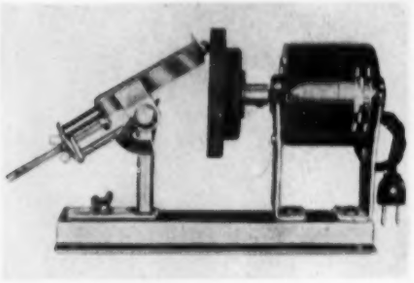
Six automatic feeds of the boring spindle are offered when descending and when rising, ranging from 0.0008 to 0.0080 in. per rev. An automatic stop for the boring spindle is also provided. A high-speed drilling attachment is aligned with the main spindles for small holes to 0.012 in. The maximum drilling speed is 3000 rpm. The vertical displacement of the transverse slide is driven by an independent motor. There are six feeds to the boring spindle.

The longitudinal travel of the table slide is 24 in. Maximum distance between spindle and table is 21 in., and the maximum distance between columns in 24 in.



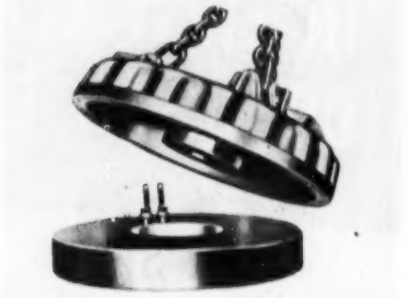
Pneumatic Air-Clamp Jig Base Holds Work for J:g Drilling

The Industrial Clutch Corp., Waukesha, Wis., introduces the air-clamp jig base, a pneumatic work-holding fixture for jig drilling. Variations in thickness of the pieces to be drilled are automatically compensated for by the air pressure. The use of sleeve spacers permits quick setups for drilling. Repetitive operations on similar pieces require the sliding of the piece into position on the base under the jig plate, turning on the air, drilling, turning off the air, and removing the piece. The jig base operates on 50-lb. minimum air pressure. Four sizes are available.



Drills Sharpened in 30 Sec. With Drill Grinder by EZ

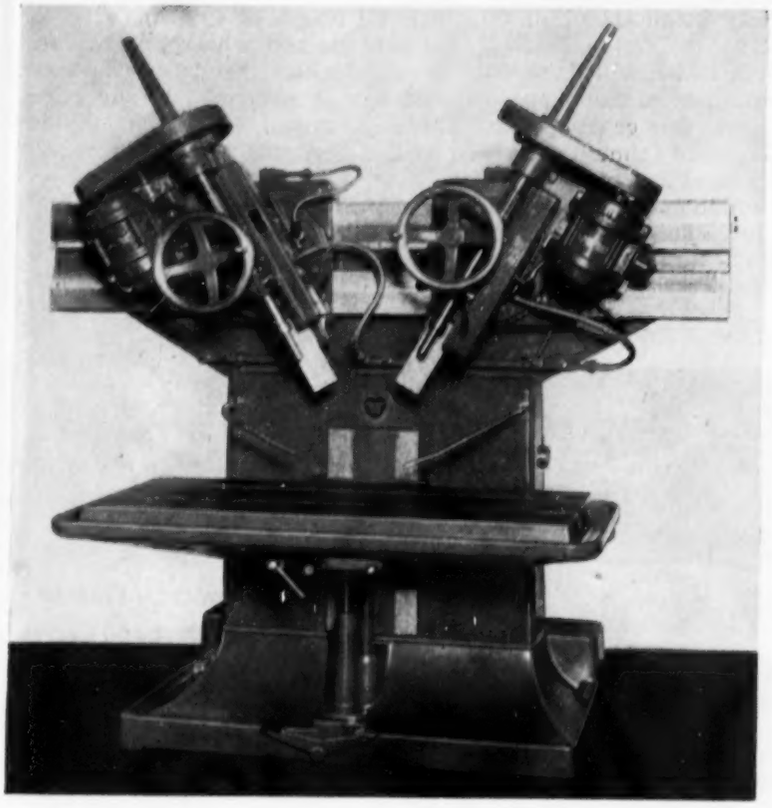
The EZ Manufacturing Co., 4408 San Fernando Road, Glendale 4, Calif., introduces a drill grinder for sharpening drills in 30 sec. The drill grinder is offered with a protractor fixture and an adjustable spacer for various length of drills. The drill sharpener is priced at $22.50 complete.



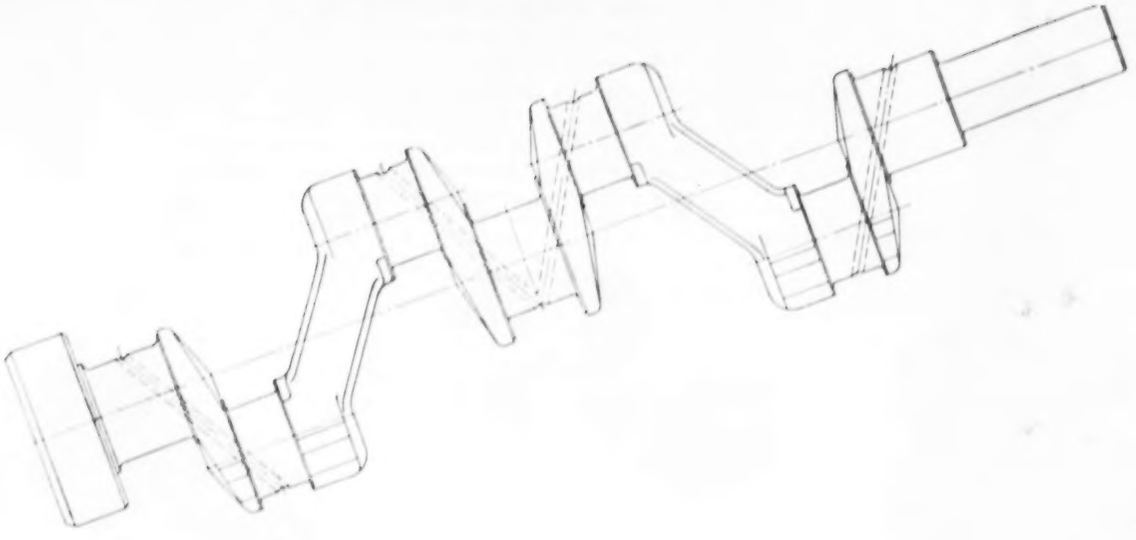
Cutler-Hammer Lifting Magnets Have Capsule-Coil Construction

The Cutler-Hammer Inc., 205 N. 12th St., Milwaukee 1, Wis., have introduced the capsule-coil-construction lifting magnet. The magnet is encased in a metal welded capsule from which moisture is removed by a vacuum process prior to impregnating the coil with an insulating compound under pressure. The construction permits removal of the magnet for repair, and a spare replacement coil can be inserted. The damaged coil can then be sent to the factory for reinsulating.

LELAND-GIFFORD



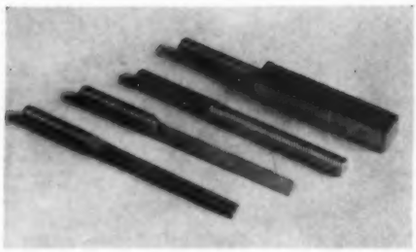
UNIVERSAL RAIL TYPE DRILLING MACHINE



- A handy machine for drilling angular oil holes in crankshafts.
- Exceptionally efficient for small lot production or for special designs and experimental parts.

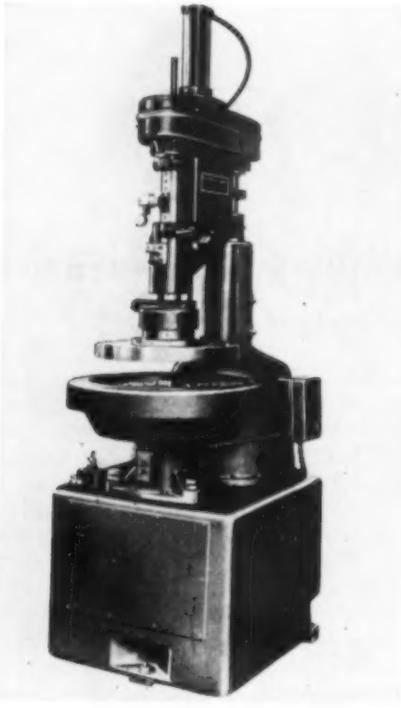
LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.



Ground-Carbide Die-Machine Files For Corrections on Hardened Dies

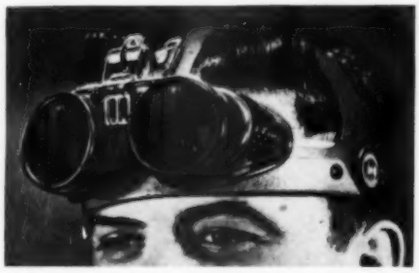
Severance Tool Industries, Inc., Saginaw, Mich., has developed ground-carbide die-machine files for making alterations or corrections on hardened dies, without the risks involved in annealing and rehardening. Dies as hard as Rockwell 63 C can be handled. Several sizes of files and four standard shapes are offered. Shapes are: round, square, rectangular and triangular. They have been produced chiefly for use on die-filing machines, but can be used manually, or in any recpirocating device.



Flat-Surface Finishing Machines Embody Bonded or Loose Abrasives

Microflat machines for finishing flat surfaces are announced by Micromatic Hone Corp., Schoolcraft and Greenlawn St., Detroit 4, Mich. In this series of six models, two types of microflat machines, both using either bonded or loose abrasives, are offered. The machine illustrated will finish two opposite sides of the part simultaneously within 0.0001 in. for parallelism.

The other machine will finish flat surfaces regardless of the shape or size of the part. One or many parts can be processed simultaneously. Surfaces produced are said to be optically flat within one light-band and can be held to a finish of one microinch rms. or less. Any material from soft copper to quartz can be finished.

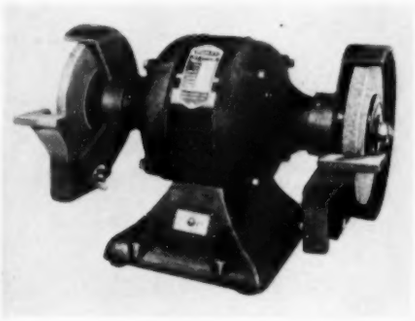


HEAD-REST SAFETY GOGGLE is made by American Optical Co., Southbridge, Mass. The goggle, designed for protection for gas welders, burners, cutters, brazers and furnace men can be thrown into off-guard position by a flick of the wrist. Because of the spring mechanism there is no overhanging weight. Adjustment to facial contours and correct pupillary distances can be made without tools. The Duraweld Coverglas goggle protects eyes against injurious light radiations, glare, flying sparks, and scale

Kinmont Universal Power Tool Is Adaptable as a Positioner

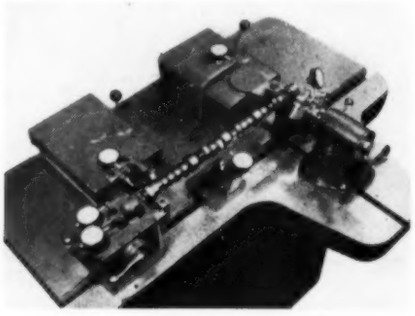
A universal power tool designed for the turning of any round, nearly round, or hexagonal object, requiring up to 400-lb. circumferential turning force at a surface speed of 3 to 26 ipm., is offered by Kinmont Mfg. Co. Inc., 718 W. Wilson Ave., Glendale 3, Calif.

The power tool can be used as a positioner for welding, cutting, fitting, grinding, threading, painting, sand-blasting, and similar operations. The power unit operates on the chain-tong principle, and weighing 71 lb., is portable. The unit has an over-all length of 40½ in., a width of 10⅛ in., and a height of 15⅜ in. It operates on either ac. or dc. power and can be plugged into any portable gas-driven arc welder in the field. A reversing switch is provided.



No. 266 Bench Grinder by Stanley Speeds at 3450 rpm. at 60 Cycles

The No. 266, ¼-hp. bench grinder is announced by Stanley Electric Tools, New Britain, Conn. The ball-bearing grinder is particularly suited for light grinding, sharpening tools, general grinding, buffing, polishing, and wire-brush work. The constant-speed induction motor can be used for continuous operation. Safety-type wide wheel guards and adjustable tool rests are featured. The guards are adjustable to permit grinding at any point on the circumference of the wheel. The speed at 60 cycles is 3450 rpm. The grinder is furnished with two wheels, 6 x 2 in., one coarse, one fine.



COMBINATION GEAR-AND-CAMSHAFT CHECKER, for checking camshaft elements held to close dimensional limits, is made by the National Broach and Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. Camshaft is laid on two journal-bearing support blocks and rotated by hand, while readings are taken of the various elements to be checked. Tooth-to-tooth spacing is checked by one of the standard Red Ring gear-checking heads

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

HOW American Phillips Screws "Make Better Sport"

both for Makers and Users of Sporting Goods

THEY MAKE WORK EASIER... in fact, American Phillips Screws make assembly a *pleasure* because, as one user says: *"They're 3 times faster to find and drive!"* And they're far easier to handle, to drive at angles, and into cranky inside corners. Any worker who "goes crooked" with slotted screws will "go straight" with American Phillips... the only screw with the tapered, engineered recess. Fatigue is banished. Production stays up all day long. *And time-savings, too, stay up around 50%.*

THEY MAKE SELLING EASIER... American Phillips Screws look new, modern, craftsmanlike... plainly say: *"Here's a top-quality product!"* And when your dealers sell the whole story of American Phillips *extra* holding strength, vibration-resistance, and greater dependability in strenuous use...then watch sales-resistance melt away. Get these double-barrelled production and sales advantages for *your* product. Write.

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AMERICAN PHILLIPS *Screws*

ALL TYPES

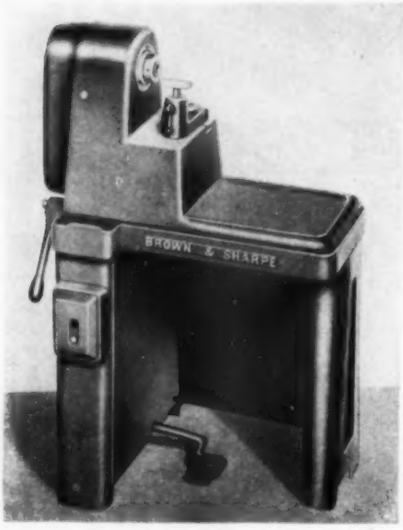
ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

Universal Valve and Tool Grinder Handles Flat-Head and 15° Valves

The No. 6 universal valve and tool grinder has been developed by Black and Decker Mfg. Co., Towson 4, Md. Flat-head and 15° valves are handled without special attachments. Valve-stem capacity ranges from ¼ to 1¼ in. and the valve-head capacity ranges to 5¼ in. Large diesel valves are adaptable to the grinder.

Equipped with a double-ended wheel spindle, rocker arms, valve stems, and tappets are ground with the aid of attachments supplied as standard equipment. An air chuck is featured which grips or releases the valve stem with the flick of a finger.

A switch slide bar automatically controls the work-head motor so that the motor runs while the valve or tool is being ground and stops when the table moves away from the wheel. Cylindrical grinding and sharpening of cutters and reamers can be handled.



Polishing and Finishing Machine Utilized for Burring, Filing

Brown & Sharpe Mfg. Co., Providence 1, R. I., offers a polishing and finishing machine which can be used for filing, burring and similar operations on small parts. The operator can either sit or stand at his work.

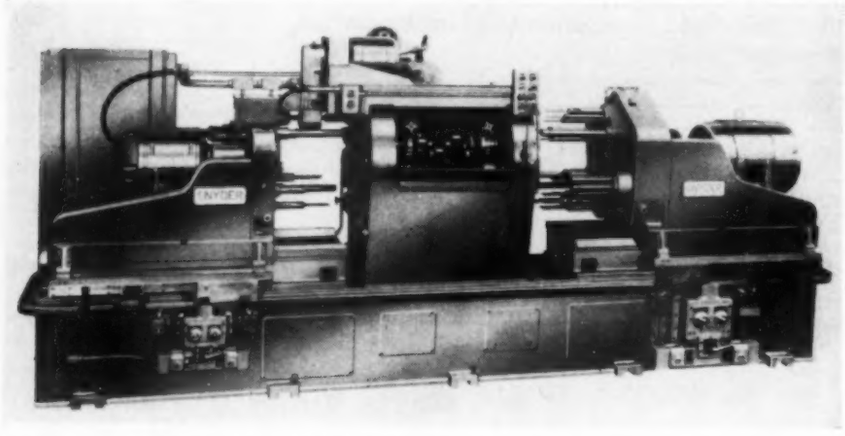
Three spindle speeds, 4500, 3280, and 2380 rpm., driven by a V-belt from a ½-hp. motor are suitable for the different materials. Pedal control of the collet and brakes provides simultaneous opening of the collet and stopping of the spindle. This leaves both hands of the operator free to load, perform the necessary operations, and remove the work.

Collets can be furnished to take stock from ⅛- to 1-in. diameter. The machine has a 9¾-in. diameter swing over the bed, and a 7¾-in. diameter swing over the toolrest.

Test Plugs, Filling Connectors Seal Plain or Threaded Holes

Mechanical Products Corp., 168 N. Ogden Ave., Chicago 7, Ill., Dept. AM, announce the Hydro-Matic, self-sealing test plugs and filling connectors equipped with expanding stems. The plugs and connectors are designed to seal plain or threaded holes in flanged or fitted openings of almost any depth in tanks, boilers, and other fabricated or cast vessels which require hydrostatic or air-pressure testing.

Testing pressure from within the tank or vessel is utilized to actuate a piston or plunger with sufficient force to hold an effective seal regardless of the actual testing pressure used. Stock sizes from ¼- to 2-in. pipe openings are available with standard flanges and are suitable for any testing pressure to 500 psi. The Type G self-sealing filling connector with bayonet lock and expanding pull rod is illustrated. Worn seals are readily replaceable.



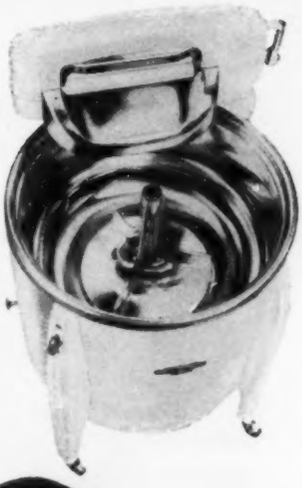
DRILLING, COUNTERDRILLING, chamfering, tapping, and reaming operations on automotive crankshafts can be done on a special machine developed by Snyder Tool & Engineering Co., Detroit, Mich. The machine is designed to maintain accurate relationship of the holes processed. Two slide units having 18 in. of feeding stroke move on hardened and ground ways. Tools are carried on multiple-spindle heads which are powered by one 10-hp. and one 7½-hp. motor. Five stations are used for working positions and one for loading and unloading. Production rate is 65 machine cycles per hr. at 80% efficiency

They're all using SHEAR SPEEDS*

*Trade Mark

for WRINGER DRIVES

"Made better gear design possible. Reduced cutting time to 30 secs." (Washing Machine Manufacturer)

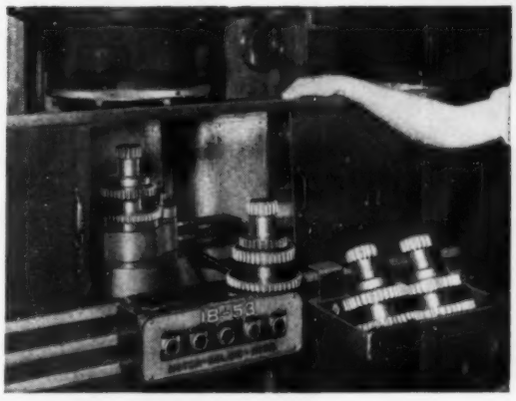


for OVER-RUNNING CLUTCHES

"Eccentric shape cam faces easily produced. Cutting time 14 secs." (Bicycle Manufacturer)

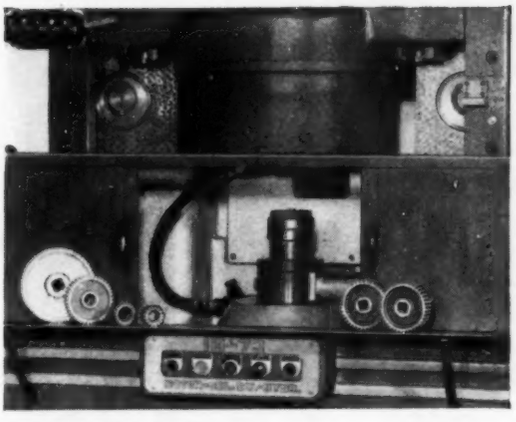
for AUTOMOTIVE GEARS

"Balances output of 8 double thread hobs plus more accurate cutting, less shaving time." (Transmission Manufacturer)

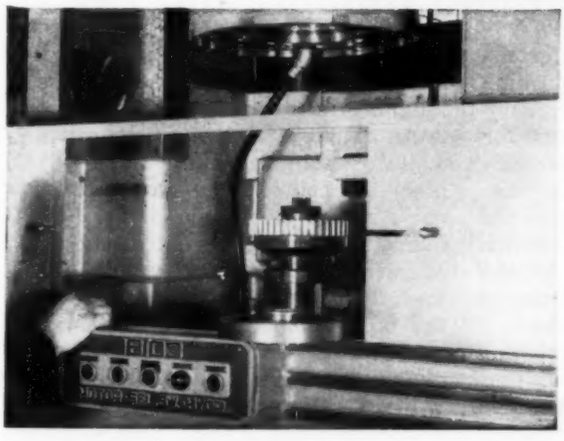


for SMALLER PRODUCERS

"One Shear-Speed* with interchangeable tooling produces all these parts for stoker drives—with time to spare." (Stoker Mfgr.)



If you have not yet investigated how the Shear-Speed* can cut costs and step up your output of gears, clutches, and other external shapes, write today for Bulletin #1800-47.



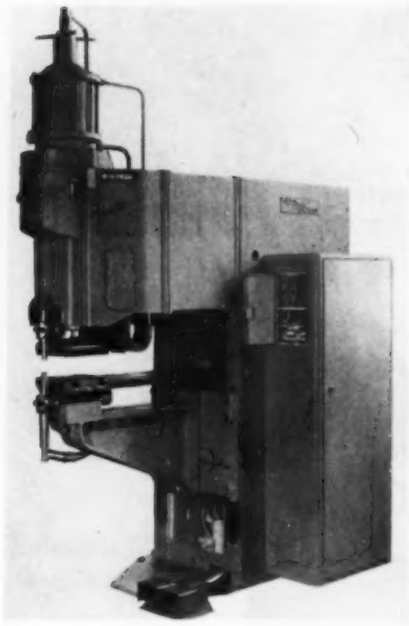
and now for BIG GEARS

The new Shear-Speed* 18103, for gears, clutches, and other external shapes up to 10 inch O.D. and 2¾ inch thick.

ORIGINATORS of GEAR-SHAVING

MICHIGAN TOOL CO.

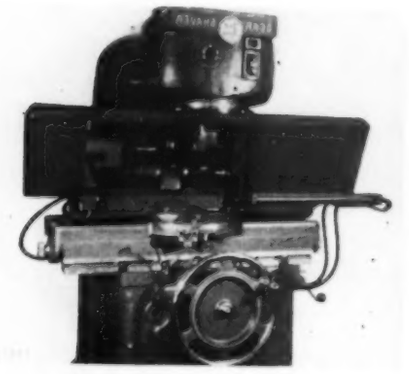
7171 E. McNICHOLS RD.
DETROIT 12, U.S.A.



Taylor-Winfield Tri-Phase Welders Offers Three-Phase Balanced Power

Taylor-Winfield Corp., 1050 Mahoning Ave., Warren, Ohio has developed the Tri-Phase welders for resistance welding. The Tri-Phase, with three-phase balanced power gives a power factor of 95 percent at reduced power demand.

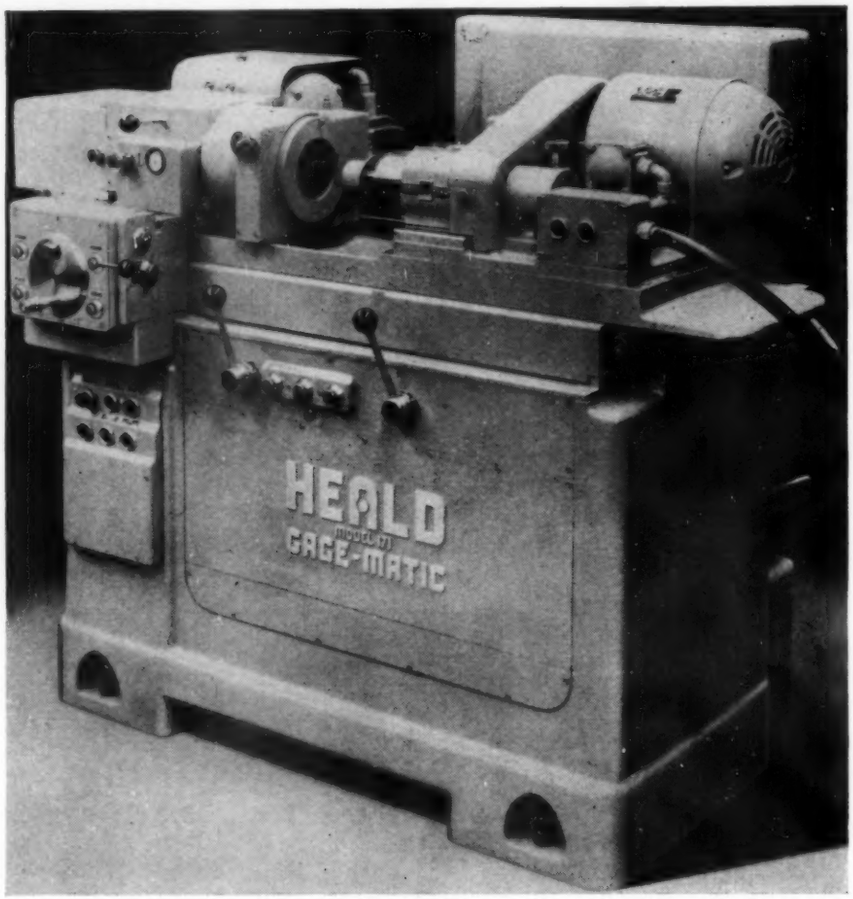
The Tri-Phase welding circuit is said to permit a greater range of shapes and sizes of work to be welded, especially in deep-throated welders. Low-carbon steel, stainless steel, aluminum alloys, magnesium alloys, monel, inconel, brass alloys, and other weldable materials can be welded on the same welder. The Tri-Phase is available in spot, seam, projection, and upset-butt welders.



Red Ring Gear-Shaving Machines Incorporate Fast-Lock Tailstock

National Broach and Machine Co., 5628 St. Jean at Drummond, Detroit, Mich., offers the Red Wing fast-lock tailstock and automatic splashguard door for gear-shaving machines. The fast-lock tailstock reduces the operation of loading the work to one motion. The same is true for unloading. A screw advance and locking mechanism makes it possible for the operator to lock the work by pushing the handle away, and to retract the tailstock for unloading by pulling the handle toward him.

The air-actuated electrically controlled automatic splash guard is available in several designs to meet varying conditions. After loading the work the operator presses the start button which automatically closes the door, and starts the coolant and cutting cycle. The cutting cycle is carried on automatically and when terminated, the coolant is shut off and the door opens automatically, leaving the finished part ready to be unloaded.



Heald Chuck-Type Internal Grinder Offers Controlled Diminishing Feed

Model 171 chuck-type internal grinder is offered by The Heald Machine Co., Worcester 6, Mass., for work up to 2 in. I.D. Machine is designed for small work and large-lot production, and is available with both Size-Matic and Gage-Matic features for automatic sizing. A single switch converts from one method to the other. Grinders can be furnished with the Size-Matic method alone.

Featured is controlled diminishing feed. Amount of in-feed diminishes from roughing through finishing feed according to pre-set rate, producing spark-out effect as size is approached.

A single control knob sets the roughing and finishing cross-feed cycle. Table speeds are controlled by individual finger-tip-action knobs. A switch controls the change from one sizing cycle to the other. Permanently lubricated wheelheads and an isolated hydraulic pump and tank are also featured. The swing over the table diameter is 13 in. Maximum length of hole is 3 in., maximum included angle (Size-Matic only) is 60°. Table feeds are unlimited between 0 to 35 fpm.

25,000th Monarch Lathe with exclusive Flame-Hardened Ways; a 14″ x 54″ Series 60 Engine Lathe purchased by B. F. Goodrich Co.—one of many repeat orders from this customer. Customer's Engineering Division was represented by its Master Mechanic in charge of Machine Tool Operations, as the lathe was made ready for shipment.

Unretouched photograph of bed of Monarch 12″ Engine Lathe after eight years' severe service. Inspector's report shows no measurable wear of ways.

Salute! from a Veteran to Its 25,000th Brother

"SO you're the 25,000th Monarch Lathe with the famous Flame-Hardened Ways! You look so sleek and sure—*and accurate*—I don't blame your purchaser for being proud of you. Monarch's just as proud of me.

"Let me tell you why. I'm eight years older than you—and I've seen a lot more service than any *ordinary* lathe ever lives to see. I went to work back in September, '40. Right after that the war began, and I started working 24 hours a day, seven days a week. Hard work, too—I was turning out short pieces—plenty of short motions of my carriage, the kind that wear you down. And even though I told my operator it was bad, he often cleaned me off with an air-hose! But all that didn't stop me—I kept right on turning out war parts 'round the clock—each one with as fine a finish, as close a tolerance as the first I ever turned.

"Well, the war finally ended—but I kept right on working—though they did let up on my hours. I work a regular eight-hour day now, right along with the other master craftsmen. Recently my owners decided to hedge on rising production costs by sending me back to Monarch to be fitted out with the latest in time-saving, money-saving attachments. That's how I happen to be here for your christening party.

"But let me tell you what they've just found out about me. When they came to tear me down for inspection, they couldn't even find *any* measurable wear on my ways! Now do you blame 'em for being proud of you—and me?"

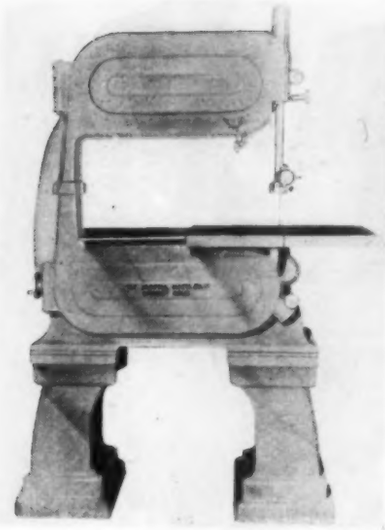
★ ★ ★ ★

The famous Monarch Flame-Hardening Process is an exclusive construction feature of every Monarch Lathe—one of many "pluses" to give you *peak production at a profit.* Write for complete details.

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

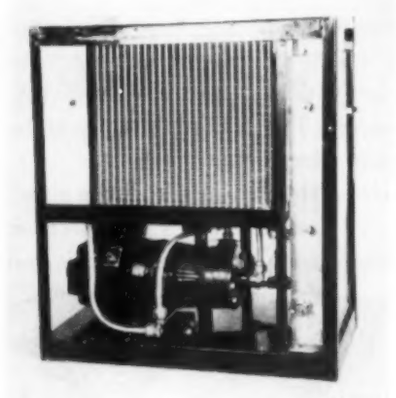
MONARCH MACHINE TOOL CO. • • • Sidney, Ohio



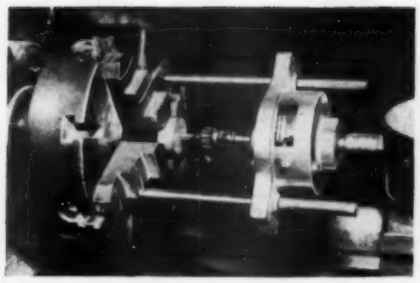
Deep-Throated High-Speed Bandsaw Has Speeds from 550 to 2700 RPM.

A deep-throated four-wheel metal-working bandsaw is introduced by T. Farrell Machine Co., Berkeley, Calif. Cutting capacity of the saw is 27 x 12½ in. The 18 x 24-in. table tilts 45° right or 10° left. An auxiliary table of 16 x 18 in. is furnished.

The four wheels are 12 in. in diameter, and the machine uses blades 10 1/3 ft. in length and from ⅛ to 1 in. in width. Blade speeds on the standard model are 550, 1050, 1750, and 2700 fpm. A low-speed model is available with a gear drive offering a range of speeds starting at 65 fpm.



HEAT-TRANSFER UNIT for cooling the magnetron power tube in an induction-heated oven is offered by Eastern Industries, Inc., 296 Elm St., New Haven 6, Conn. The heat generated by the magnatron tube is dissipated at the rate of 11,000 Btu. per hr., by circulating a cooling medium through the tube. The heavy-duty unit, Model No. 5-H.T.U., will dissipate 3000 watts within a temperature rise of 40 F. above ambient. Size is 14 x 24 x 27 in.



TAPPING HEAD is made by Errington Mechanical Laboratory, Inc., Staten Island 4, N. Y. Known as the auto-reverse turret-lathe tapping head, it permits a hole to be tapped and the tap to be backed out without stopping the work or reversing the machine in a turret-lathe setup. With the aid of a friction clutch, blind-holes can be tapped without breakage. The tapping head can also be used on drillpress work for production tapping. For this the Errington head has a 2 to 1 reverse and uses guide bars

Hand-Operated Portable Press Produces to 8-Ton Pressure

Studebaker Machine Co., 1221 S. 9th Ave., Maywood, Ill., introduces a hand-operated portable hydraulic press for laboratory or production work. Electrically heated platens, for plastics or other operations that require temperatures, are offered as optional equipment. The heating element is thermostatically controlled. Operation of the hand lever produces up to 8-ton pressure between platens.

The unit is self-contained and self-powered, and can be adapted to broaching, assembling, piercing, oil-grooving, riveting, sizing, forming, and other operations. The base is 10x10 in. and the height is 13 in. The hydraulic ram has a 3-in. travel, and platens are 5½ x 7 in.

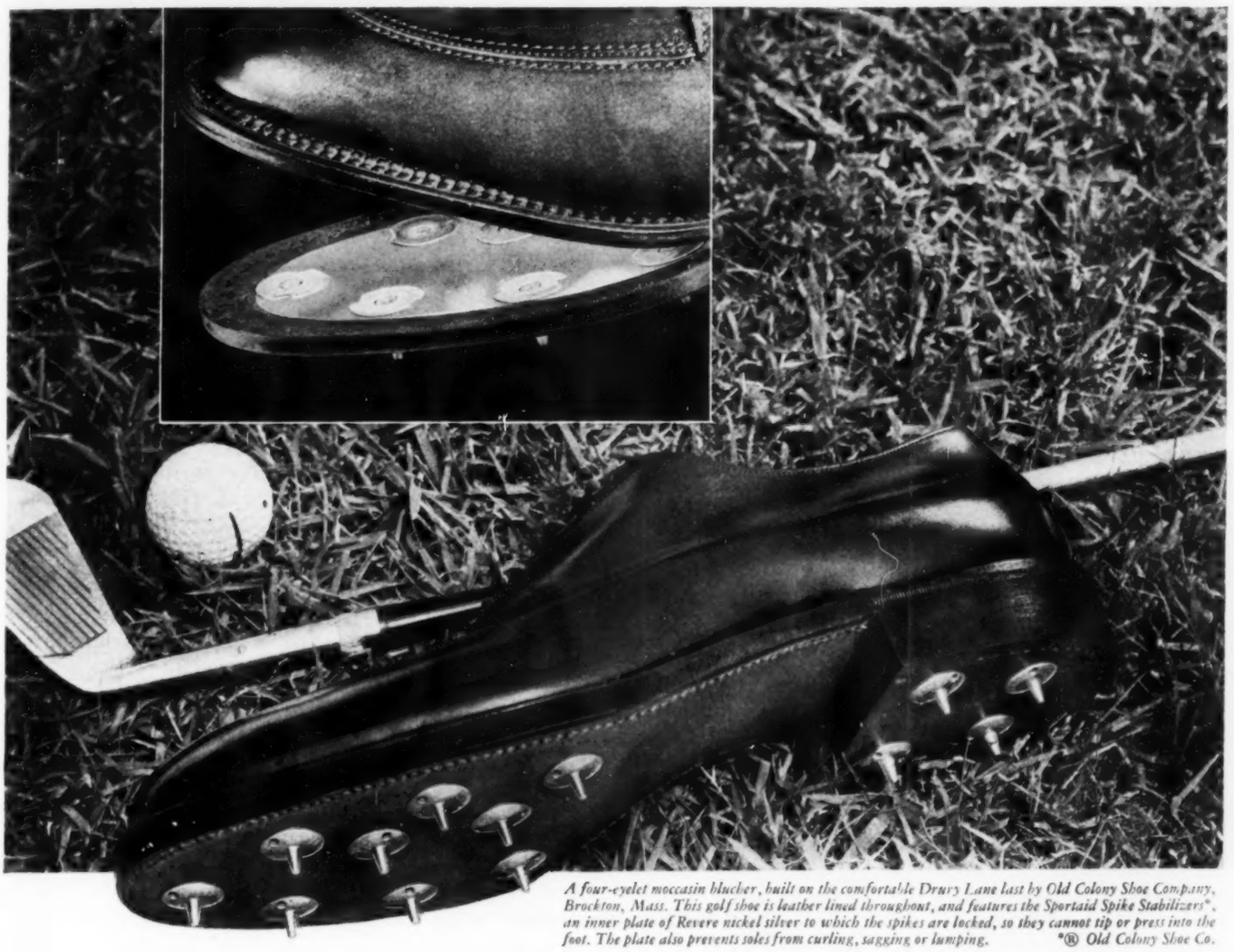
Canopy Type of Overhead Guard Offered for Power Fork Trucks

A heavy-duty canopy-type overhead guard is offered by Lewis-Shepard Products, Inc., 276 Walnut St., Watertown 72, Mass., for power fork trucks. The guard is constructed of heavy tubular arc-welded steel and supported at four points on the fork truck. It is designed to protect the operator from falling objects. An expanded metal screen to fit over the horizontal portion of the guard is available where required. The canopy type guard is detachable.

High-Speed Form-Tool Blanks Utilized with Circular Cutters

The Production Service Co., 1060 Broad St., Newark 2, N. J., offers a line of high-speed form-tool blanks for use in making finished form tools for automatic-screw machines using circular cutters. Blanks are made from a standard brand 18-4-1 high-speed steel and can be furnished soft or in a hardened condition having a 64-65 Rockwell C hardness. They are available with either right- or left-hand threading.

A CASE IN WHICH AN "EXPENSIVE" METAL PROVES MORE ECONOMICAL AS WELL AS BETTER



A four-eyelet moccasin blucher, built on the comfortable Drury Lane last by Old Colony Shoe Company, Brockton, Mass. This golf shoe is leather lined throughout, and features the Sportaid Spike Stabilizers®, an inner plate of Revere nickel silver to which the spikes are locked, so they cannot tip or press into the foot. The plate also prevents soles from curling, sagging or lumping. *® Old Colony Shoe Co.*

IT is the most natural thing in the world for engineers and purchasing agents to check prices of materials, and when they find that one costs more per pound than another, to conclude, in the absence of other information, that one is more expensive than the other. However, it is often the case that much more than price is needed to determine which is actually the most desirable as well as economical. Take these golf shoes, for example.

Golfers for years were annoyed by spikes that tipped, and dug into the feet instead of the fairway. The Old Colony Shoe Company did something about this. It developed a golf shoe with an inner steel plate to which the spikes are anchored. To prevent rust, the steel was cadmium plated. Golfers went for the shoe. They still do, but what they do not realize is that now the plate in their shoes is made not of steel but of Revere nickel silver, spring grade, which is inherently rust-proof and needs no plating whatever.

In making this switch, Old Colony was adhering to its customary policy of making the best shoes it knows how to turn out. Nickel silver costs more per pound than steel, but it was selected because it provides absolute assurance that the plate is equal in quality to the rest of the shoe materials. However, when the cost figures were in, it was discovered, surprisingly, that the nickel silver plates cost less than the steel ones, due to elimination of the plating and associated operations . . . Naturally, before the final decision was reached to use nickel silver, careful tests were made. Revere cooperated in these and was delighted when the metal proved itself on the basis of service. That it also has the advantage of economy is just so much the better . . . Quite often it is true that cents-per-pound are not as important as quality service and cents-per-finished-part. Revere is always glad to collaborate in studying such problems.

•

REVERE

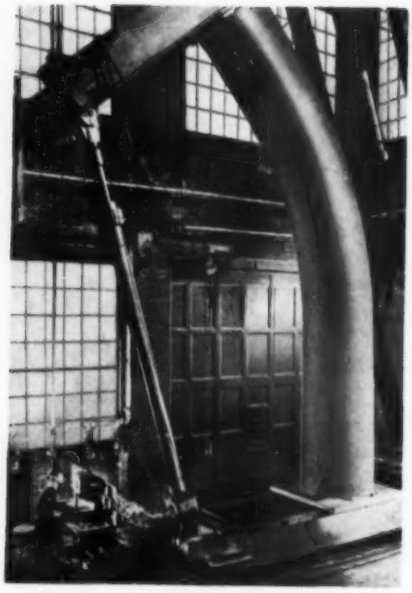
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

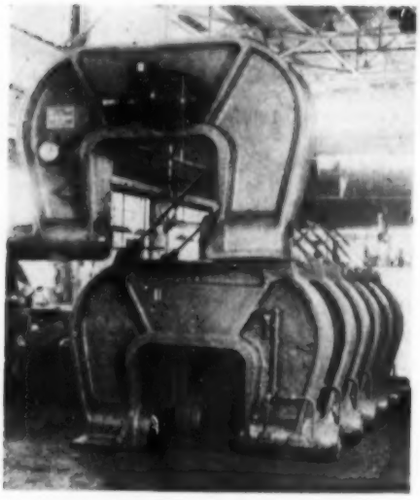
230 Park Avenue, New York 17, New York

• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.



PIPE-BENDING MACHINE capable of bending a pipe large enough to garage a limousine is offered by the M. W. Kellogg Co., Jersey City, N. J. Pipe diameters up to 100 in. can be handled. The method bends pipe in the hot state under hydraulic pressure. It is adaptable to small and large diameters, to thin- and thick-walled pipes, and to short- or long-radius bends. The smooth bend reduces erosion and eddy currents due to sudden changes in direction or to sharp-cornered fillets which raise stresses



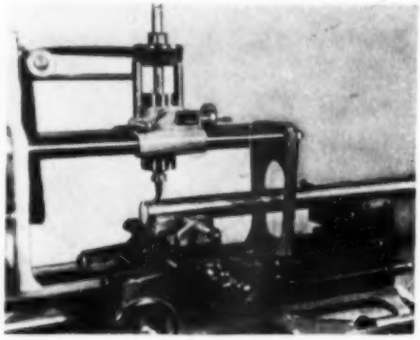
Watson-Stillman Portable Press Has a 200-Metric-Ton Capacity

A portable hydraulic press with a 200-metric-ton capacity, is offered by the Watson-Stillman Co., Roselle, N. J. Capacity of the machine is adjustable by means of a padlocked, bi-pass safety valve from a maximum of 200 metric tons. A dial gage gives direct reading of pressure at all points in the working stroke. The speed and position of the ram is governed by a lever-controlled operating valve.

The machine is specially designed for use in European railroad-shop practice, where an overhead crane brings the portable forcing equipment to the driving-wheel sets rather than taking them to stationary forcing presses for assembly and disassembly.

Sample-Marshall Diamond Tool Has Bond That Withstands Shock

Sample - Marshall Diamond - bonded tools are offered by Triangle Equipment Co., Inc., 45 River Road, Nutley, N. J. Each diamond particle is set individually on the working surface and imbedded in a manner to support the adjoining particles. The bond is said to withstand the constant shock and abrasive action generated by high speeds.



Vertical-Milling Attachment Offered for All Bench Lathes

A vertical-milling attachment, which can be applied to all makes of bench lathes, is made by Palmer Industries, Inc., 6149 South Sangamon St., Chicago 21, Ill. The compound of the lathe is removed, and the vise slipped on in its place. Longitudinal feed and cross feed on the lathe are used in the same manner as on a milling machine. Adapters are provided for each make of lathe.

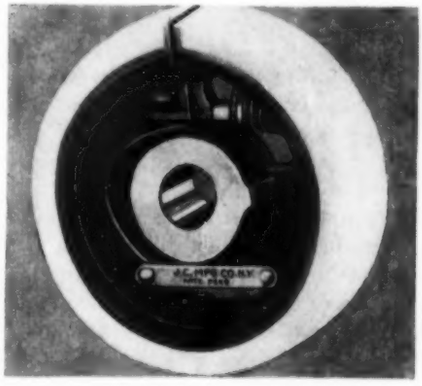
The attachment is driven by the lathe spindle through V-belt and adjustable pulleys. The attachment will make a cut 8 in. long on the longitudinal feed and half of the distance of the cross feed. It will take stock up to 3 in. in diameter under the cutter.

End mills to 1 in. can be used, and in some cases 2½-in. circular cutters can be used. Surface grinding can be accomplished using an inverted-cup wheel.

Spot-Welding Press by Clearing Makes Many Welds Simultaneously

A spot-welding press, capable of handling large complicated sections is offered by the Clearing Machine Corp., Chicago, Ill. The press performs the welding job in one step. Several welds can be done simultaneously. Actuated by a toggle-link mechanism, an up-moving platen with four-point suspension brings the work to the electrodes.

The welding operation is automatically controlled from a special panel. Each time the press reaches the top of the stroke, a contact on this control panel energizes the automatic-welding panel, causing the actual welding process to be performed in the required sequence with the necessary timing, while the press dwells in a closed position.



ABRASIVE WHEEL made by J. C. Manufacturing Co., 259 Seventh Ave., New York, N. Y., is offered to prevent accidents that occur when a sanding wheel opens or breaks while in operation. The safety abrasive wheel has a 5- or 6-in. O.D., a ⅞-in. bore, a 1½ in. wide abrasive, and a rotary locking mechanism. The wheel is guaranteed not to open while in motion

FOR YOUR BIGGER JOBS

... a truly powerful machine

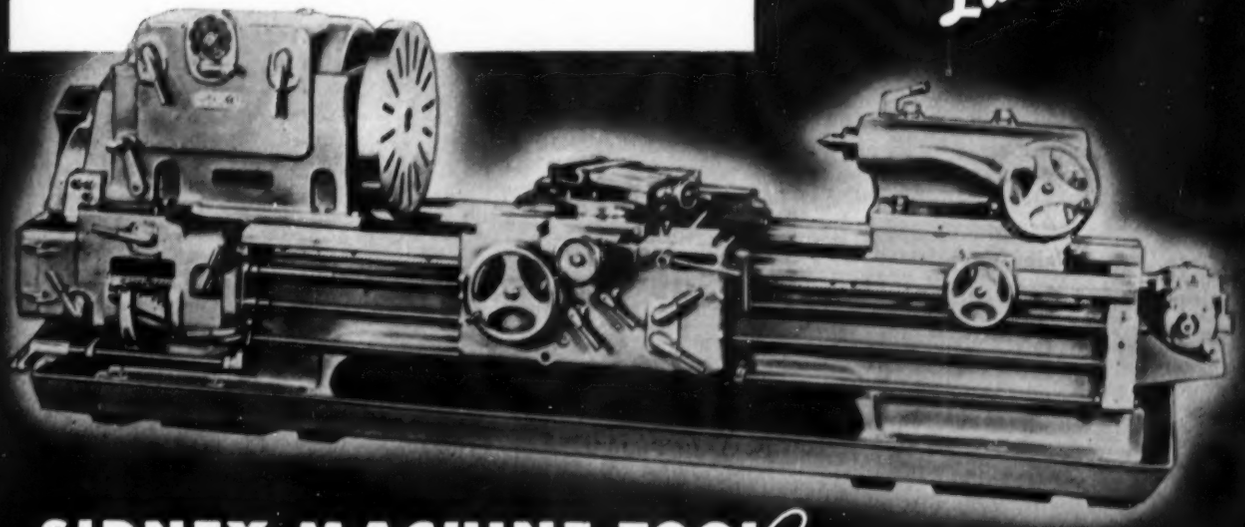
From the base up rigidity is emphasized. For example, the four wall bed is of semi-steel, nickel mixture having close grained hard bearing carriage ways—beds have three vees providing extra rigidity for both straight and taper turning. Also in addition to usual double wall cross girts there is a double wall center girt for strength and rigidity.

Then as on all 16 speed Sidney lathes the exclusive Sidney continuous tooth herringbone geared headstock which delivers more power smoothly on all cuts.

If your work calls for a swing up to 32 inches—put it on a Sidney for rigidity—closer tolerances and ultimate economy.

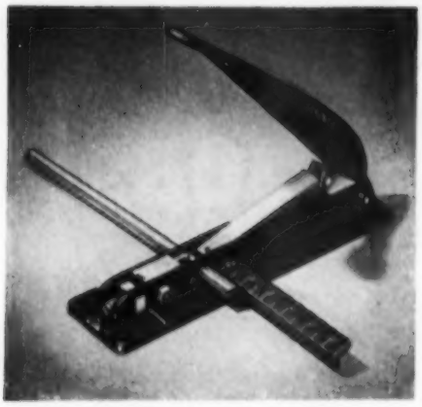
Bulletins on all sizes available.

Sidney 32" Lathes



SIDNEY MACHINE TOOL *Company*

BUILDERS OF PRECISION MACHINERY SINCE 1909 — SIDNEY, OHIO



Tools and Stock Spring Kits for Looped, Hooked Extension Springs

Tools and tool stock spring kits for making small special looped or hooked extension springs, have been developed by Gardner Wire Co., 5045 W. Lake St., Dept. A-M, Chicago 44, Ill. Gardner's Hook-Kon, Senior spring kit, provides the tools and stock springs required to make many sizes of individual extension springs in lengths to 12 in., and up to ½ in. in diameter with looped or hooked ends. A Junior spring kit is also offered.

The Hook-Kon spring looping tool is a hand tool for looping the ends of coiled springs. Center single or double loops and half-loop hooks or side loops or hooks on the ends of coiled-wire springs can be formed with this tool.

The Gardner No. 1-S spring cutter, illustrated, cuts all wire up to 0.062 in. in diameter, and also cuts coiled-wire springs up to ½ in. in diameter. The cutter is 3x3x12 in. with the scale turned back.

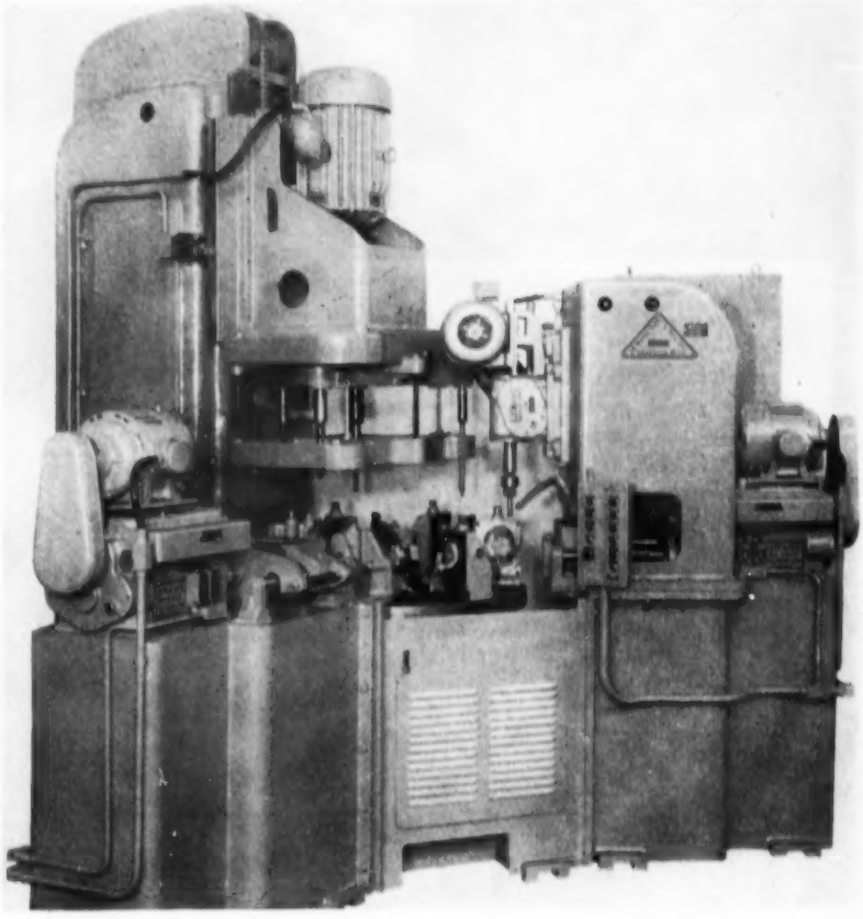
All-Purpose Lathe Toolholder Replaces Four Separate Holders

The McKenzie all-purpose lathe toolholder is offered by McKenzie Engineering Co., Newtown, Conn. The toolholder takes the place of four separate toolholders for boring, threading, cutting off and turning, and uses the full length of the toolbit instead of cutting off part to suit the holder.

Toolbit No. 1 in the holder for boring is ground at the end. No forging is needed. The toolbit can be set back for shallow holes and for tapers down to 1/16-in. drill hole. The second toolbit has one end ground for regular thread cutting, and the other end ground for inside threading. The toolbit can be removed to regrind without disturbing the setting of the toolholder. The third toolbit is for regular cut-off with a narrow and a wide end. The fourth has one end for turning steel and other materials and the opposite end without rake for brass and bronze. The toolholder is made for 3/16- and ½-in. toolbits.

Sponge-Rubber Mats by Flexi-Mat Will Combat Foot-and-Leg Fatigue

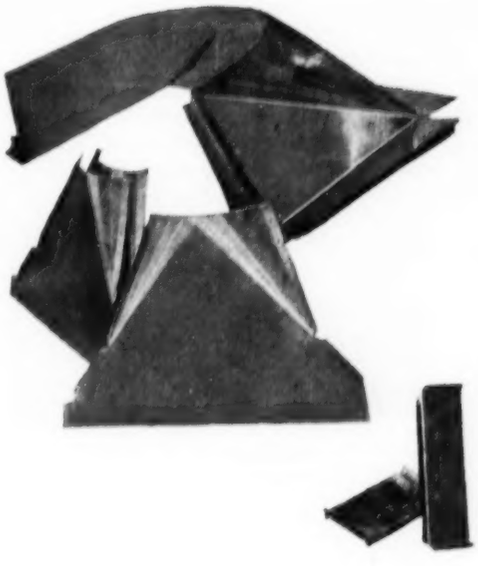
Flexi-Mat Corp., 215 W. Illinois St., Chicago 10, Ill., offers sponge-rubber mats with tile-rubber top surfaces for comfortable footing. The mats are cut in sizes to fit the requirements of the standee worker from process sheets 36 in. by 30 ft. For areas where oil conditions prevail, the mats are made of oil-resistant Maltese Neoprene with a deep-etched design on both sides to prevent slipping and dangerous falls.



LeMaire Special Automatic Machine Has a Six-Station Indexing Table

A special machine made by Le Maire Tool & Mfg. Co., 2657 South Telegraph Road, Dearborn, Mich., is being used to drill, spot-face, ream, countersink, and tap seven holes in approximately 138 automotive-transmission rear-bearing retainers per hr.

Three different types of units have been combined: a vertical machine, slide-type drilling unit, two small horizontal twin-ram quill-type drilling units with single spindles, and a vertical-leadscrew tapping unit with a single spindle. These are grouped around a 36-in. diameter six-position automatic indexing table having a hydraulic indexing mechanism. One part is completed at each cycle of the machine. A single push-button operates the automatic cycle. The coolant is pumped from a tank built into the table base.



. . . . . they use STURDYBENDER to boost production of ventilator bases

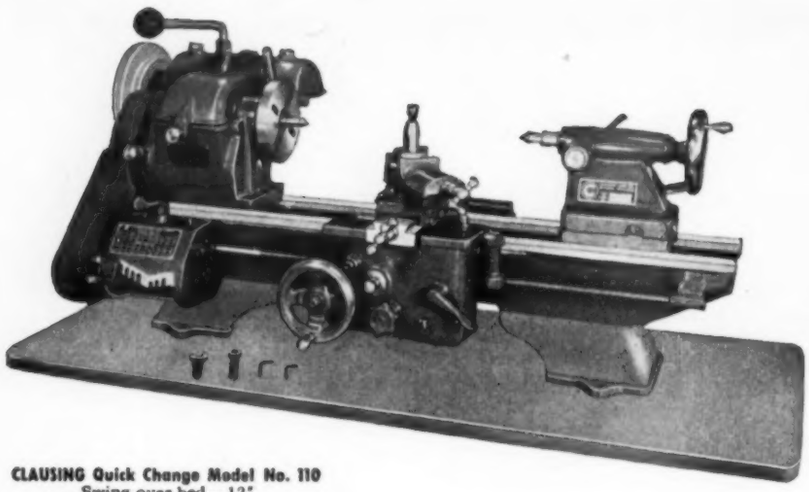
There are a lot of "angles" to making ventilators—calling for some very complicated bending of materials. That's why the Burt Manufacturing Company uses STURDYBENDER in their plant at Akron.

Photo above shows the forming of ventilator bases, from flat 24 ounce copper sheet into finished shapes—bristling with flanges and varying radii. Burt production men like the STURDYBENDER. They get more production per hour, greater precision, and down time for maintenance is negligible.

STURDYBENDER Presses are unsurpassed for speed, accuracy, safety and endurance. And—they might be just what you need for the bending and forming of your product. Write today for literature.

THE CYRIL BATH COMPANY
6910 Machinery Avenue • Cleveland 3, Ohio

Clausing LATHES



CLAUSING Quick Change Model No. 110
Swing over bed—12"
Swing over carriage—7½"
Distance between centers—24"

Accuracy THAT "STAYS PUT"

Exacting users prefer CLAUSING Lathes because of their adaptability, convenience, and sustained accuracy even after years of service.

CLAUSING Lathes are precision built for precision work. The bed is a solid close grained gray iron casting made rigid by inverted U and box braces. All beds are rough milled, seasoned, then rough and finish ground. Vee and flat ways are machined to within .001 inch of parallelism. Husky carriage is gibbed both back and front to prevent climbing and insure maximum rigidity. Bearing surfaces on cross slide, saddle, and tailstock are checked for close contact not just the high spots which may check accurate but quickly wear out of alignment. Compact headstock with built-in countershaft is a single streamlined unit guaranteed to within .001 inch of absolute accuracy.

CLAUSING Lathes roll smoothly on adjustable Timken tapered roller bearings—plenty of extra stamina for high speed and end thrust. Final machining of spindle is done with the spindle running on its own bearings, assuring concentricity.

Before you buy—investigate CLAUSING for economy, convenience, and accuracy. Write for literature.

CLAUSING MANUFACTURING CO.

227 RICHMOND ST. OTTUMWA, IOWA

MAIL COUPON FOR DETAILED SPECIFICATIONS

CLAUSING MANUFACTURING CO.
227 Richmond St., Ottumwa, Iowa

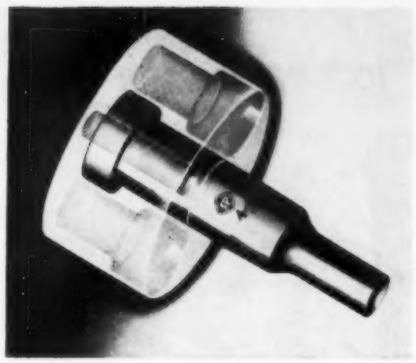
Please send complete literature on Clausing Precision Lathes.

Name_____

Address_____

City_____

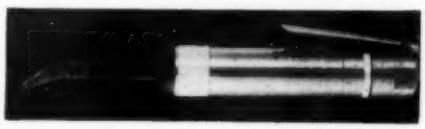
State_____



Head-Type Punches, Retainers Offered by Porter Precision

A line of head-type punches and punch retainers is offered by the Porter Precision Products, Cincinnati 12, Ohio, and distributed by Diemaker Supplies, Inc., Detroit 11, Mich. The first four series are furnished in a minimum length of 1½ in., which is said to allow greater range of applications, required in short shut heights. A companion line of round-type retainers for these punches is optional in two sizes.

WELDING AND HEATING TORCH, Models 160 and 160-G, are marketed by Weldit, Inc., 990 Oakman Blvd., Detroit 6, Mich. It is a three-hose torch, using two tanks of acetylene and one of oxygen. Torch is said to be of particular advantage in welding, heating or brazing broken parts on heavy machinery, expanding tie rods, and similar applications. A quick-operating oxygen cutoff is featured. Torch can be supplied with a two-valve control for using propane, natural or manufactured gas and oxygen for heating purposes



Scaling Hammer for Rust Removal Offered with a Lever Throttle

The S-1 scaling hammer with a lever throttle is offered by The Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio. The hammer can be used for weld-flux scaling, weld-spatter removal, paint scaling, rust removal, and other applications. The lever throttle allows the tool to be held

Converting to Welded Design Cuts Costs 20% ... Speeds Delivery

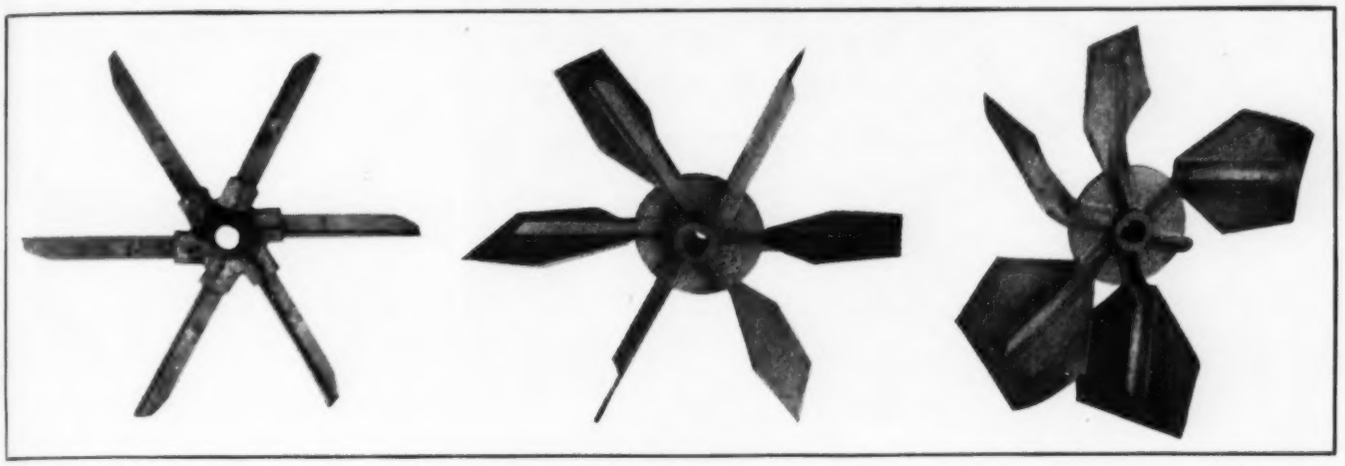


Fig. 1. Original construction. Riveted steel blades cast in iron hub. Cost approximately 25¢ per pound including riveted blades.

Fig. 2. Present all-welded steel construction. Steel blades and spokes arc welded to a steel plate hub. Cost approximately 20¢ per pound.

Fig. 3. Damaged all-welded steel impeller shows welds intact.

By W. R. Patterson, Superintendent
Dixie Manufacturing Company
Baltimore, Maryland

PART of our business is building planing mill exhaust fans for all types of industrial applications. Since each unit must be built to individual order, our shop fabricating methods must be very flexible if costs are to be held down. Arc welded construction has proved to be the only practical solution to this manufacturing problem.

Arc welding enables us to use all types of mild carbon and stainless steels with a resulting stronger product. By eliminating many time-consuming delays waiting for parts originally needed for this work, our manufacturing schedule has been cut from 4 months to 4 weeks. This prompt delivery gives us a decided sales advantage to customers requiring quick shipment.

The superiority of our welded design has already received wide customer acceptance. A number of old line customers now insist they will accept nothing but welded construction.

The impeller unit (Fig. 1) was originally constructed by casting the fan blade spokes into an iron hub. To these spokes we riveted the fan blades at a total unit cost of approximately 25¢ per pound. Under heavy load conditions, a break in the hub would cause the impeller to "explode" resulting in major damage to the blower unit and bothersome delay for the customer making repairs.

The present all-welded impeller (Fig. 2) has the blade spokes, consisting of two angles, arc welded to a flame-cut steel plate hub. The blades of shear-cut plate are welded to those spokes. The cost of the arc-welded impeller is approximately 20¢ per pound, representing a reduction in cost of approximately 5¢ per pound or 20%.

The greater strength of the welded construction is illustrated by a mishap in which a heavy block was accidentally sucked into the blower intake. The photo (Fig. 3) shows how the blades were bent. Although the force of the mishap sheared the steel angles, the welds themselves remained intact.

The all-welded drive-shaft foundation base (Fig. 4) replaces a heavy cast base. Component parts are sheared from steel plate and assembled with arc welding, using "Fleetweld 7" and 400-amp. Lincoln "Shield-Arc" welders. A previous cast iron suction intake has been converted similarly to arc welded construction by fillet welding flame-cut plate to formed frame members.

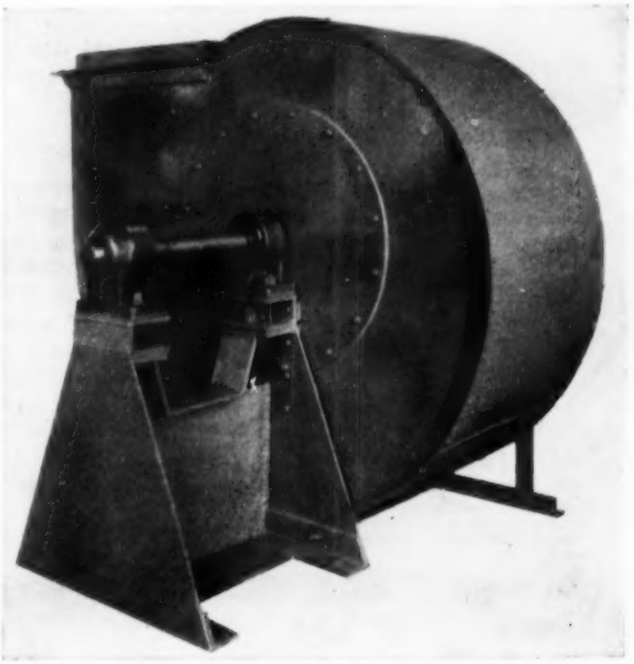
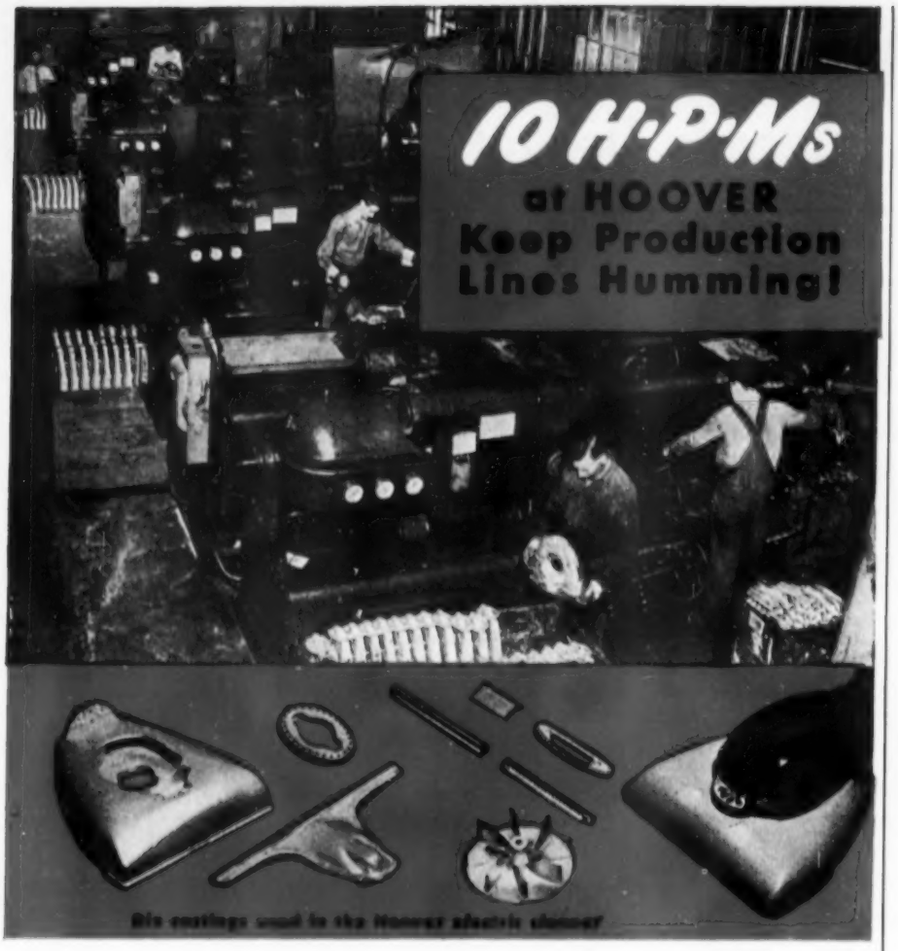


Fig. 4. Complete blower unit. Shows all-welded drive shaft base and suction intake. Cast base cost 15¢ per pound. Welded steel base cost 12¢ per pound.

The above is published by LINCOLN ELECTRIC in the interests of progress. Machine Design Studies are available to engineers and designers. Write The Lincoln Electric Company, Dept. 37, Cleveland 1, Ohio. **Advertisement**



1

H-P-M die casting machines are the answer to production of intricate parts for Hoover electric cleaners as well as millions of parts that Hoover supplies to other manufacturers. Die castings permit greater freedom of design . . . better, more uniform, and lighter precision parts . . . and a decided savings due to high production output, lower material costs, fewer machining operations, less scrap.

2

H-P-M die casting machines are putting the "skids" under production costs in many companies where high priced material and labor are threatening profits. Why not take a tip from Hoover? Change to die castings. Let us show you how to make precision metal parts better . . . faster . . . cheaper with H-P-Ms. Two basic types of machines—(1) cold chamber, (2) submerged plunger, are available in a complete range of sizes. Call in a nearby H-P-M engineer to recommend the correct type and size for your job.

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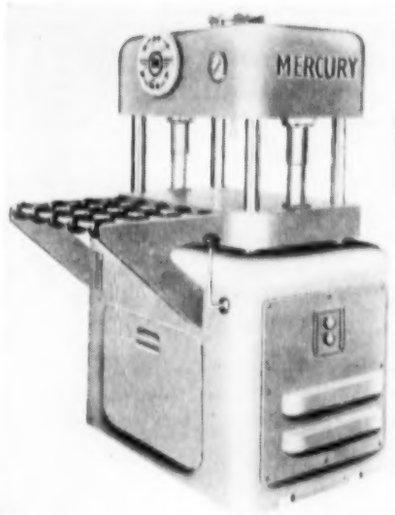
HPM *All-Hydraulic Self-Contained* DIE CASTING MACHINES

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

and operated in one hand. It is designed so that light pressure on the lever meters sufficient air for light work, heavier pressure gives full power.

The chisels are furnished in blanks, flats and spoon shapes, and a full line of star drills is available in sizes of 3/16 to ¾ in.

GRINDING-WHEEL DRESSERS are made by Crown Industrial Products Co., 1519 E. 53rd St., Chicago 15, Ill. Listed as the Tru-Dress grinding-wheel dresser, it removes the irregularities in the wheel and improves the cutting action. The emery wheel in the dresser turns fully on its bearings. Dressers can also be used to shape wheels for grinding special contours. The Tru-Dress is available in two sizes; one with a 3-in. dia. emery wheel, and the other with a 4-in. wheel. Provision is made for lubrication



Lower Platen on Hydraulic Press Moves Vertically Under Pressure

Mercury Engineering Corp., 2100 North Farwell Ave., Milwaukee, Wis., announces a hydraulic press known as the Mercury Series HD hydraulic press. The traveling lower platen moves vertically under hydraulic pressure. The upper platen carries the dies in fixed position and is provided with either air or spring

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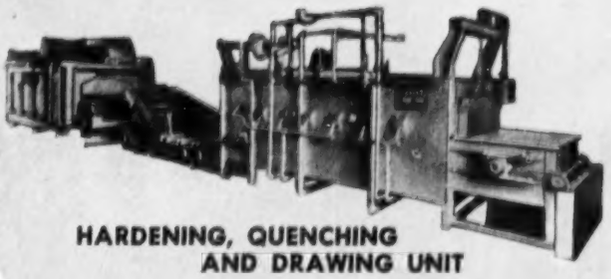


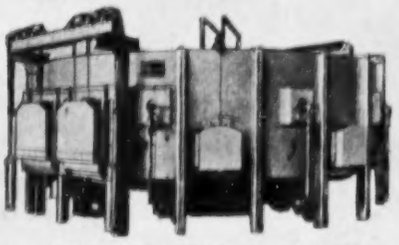
HARDENING, QUENCHING AND DRAWING UNIT

- ***Longer* furnace life • *Greater* production**
- ***Lower* operating cost**

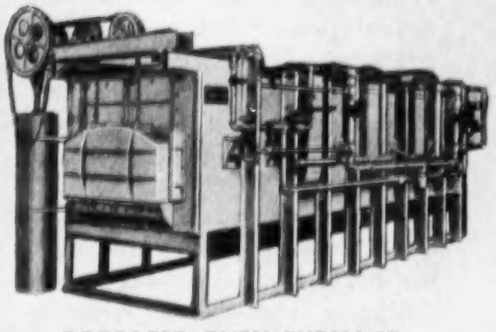
As a division of Sunbeam Corporation we have the opportunity of working with our furnaces in the production of Sunbeam appliances, lawn sprinklers, sheep shears, animal clippers, etc. In manufacturing our own products we must contend with practically every heat treating problem faced by industry —a position unique in the furnace manufacturing field.

This experience with our own furnaces in large volume production enables us to render a service to you far beyond other manufacturers. That is one reason why Sunbeam Stewart Furnace installations have been so successful. They are based not only on furnace engineering ability, but on practical experience under actual operating conditions. We have learned through actual experience the factors that give longest furnace life . . . greatest production . . . best quality . . . and lowest operating cost.

Our highly trained technical staff of furnace engineers who for over 50 years have built furnaces for the leading companies throughout the United States and abroad are qualified to recommend the correct type of furnace to meet your requirements.



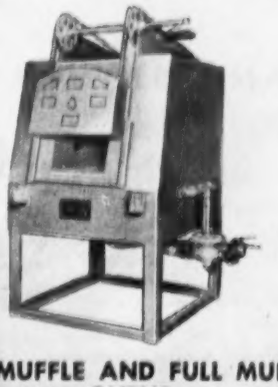
ROTARY HEARTH FORGE



PORTABLE OVEN FURNACE

A letter, wire or 'phone call will promptly bring you information and details on Sunbeam Stewart Furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a Sunbeam Stewart engineer will be glad to call and discuss your heat treating problem.

RECIRCULATING FURNACES



SEMI-MUFFLE AND FULL MUFFLE OVENS

SUNBEAM STEWART INDUSTRIAL FURNACE DIVISION of SUNBEAM CORPORATION

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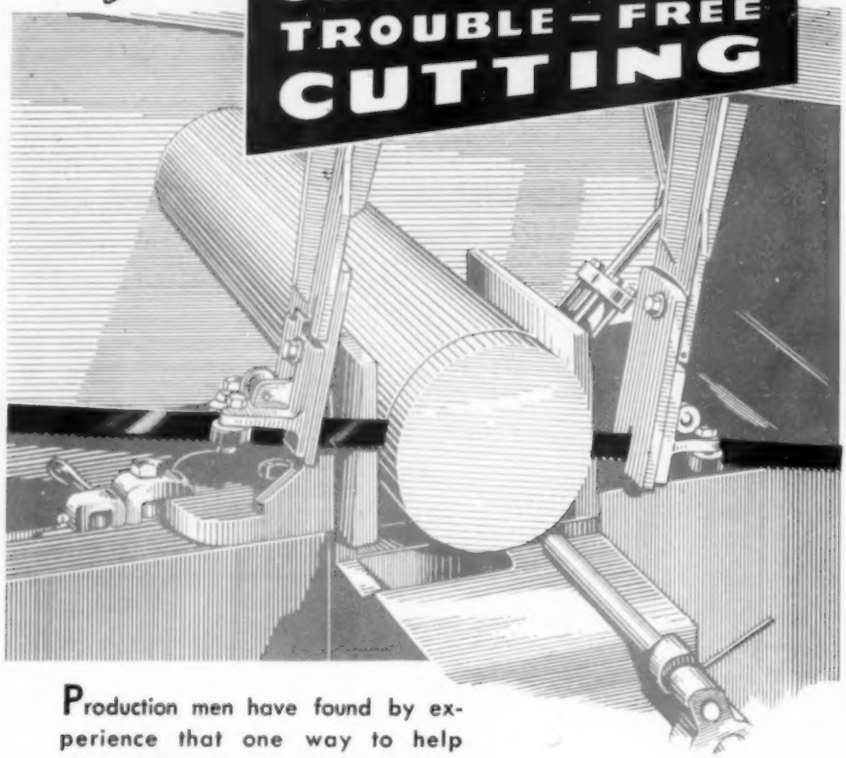
for SMOOTH, EASY and TROUBLE-FREE CUTTING



Production men have found by experience that one way to help eliminate troublesome blade failures and frequent blade changes on band saw machines is to apply Barnes blades. These are the blades that cut with greater efficiency even at standard speeds and feeds . . . that don't have to be overloaded to accelerate production or cut particularly tough metals.

Let Barnes band saw blades . . . noted for their smoother, easier cutting and trouble-free, economical performance . . . prove their qualities on your band saw operations. Check your needs with your Barnes Distributor who carries a complete line for every metal cutting requirement.

BARNES BAND SAW BLADES

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  . . . for general all-purpose cutting
- **ARC-LINE**
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- **SKIP-TOOTH**
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The Barnes "Handbook of Metal Sawing" will help you get maximum efficiency from your band saw. Write on your letterhead for your free copy.

BARNES Established 1919

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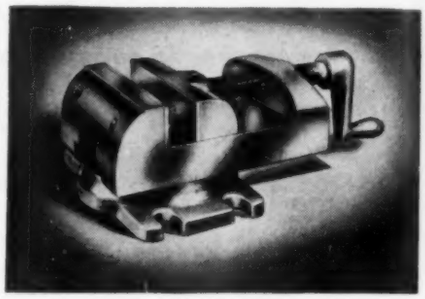
knockouts to facilitate unloading.

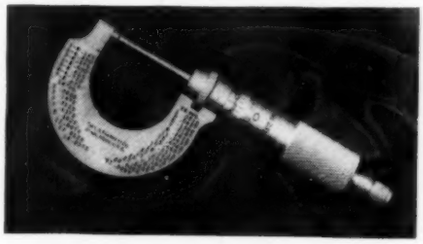
The Model HD-25 machine has 20x24-in. upper and lower platens and is rated at 25 tons, with 15 1-in. or 3 5-in. strokes per min. The stroke of the press can be varied from 0 to 5 in. by a hand control at the front.

The press can be equipped with standard 3½-in. high cutting dies, ruled dies, or special tooling as required. Other Mercury models in this series provide pressures up to 65 tons and strokes to 6 in.



Milling Machine, Drillpress Vise Offers a Calibrated Swivel Base

A swivel-base milling-machine and drillpress vise is announced by the Erwood Co., Crystal Lake, Ill. The base and frame are cast from semi-steel. Jaw plates are replaceable and are hardened and ground steel. The jaw width is 4 in. with an opening 2½ in. and a depth of 1 in. The swivel base has four mounting slots and is calibrated in 180° of rotation. The vise weighs 12 lb.

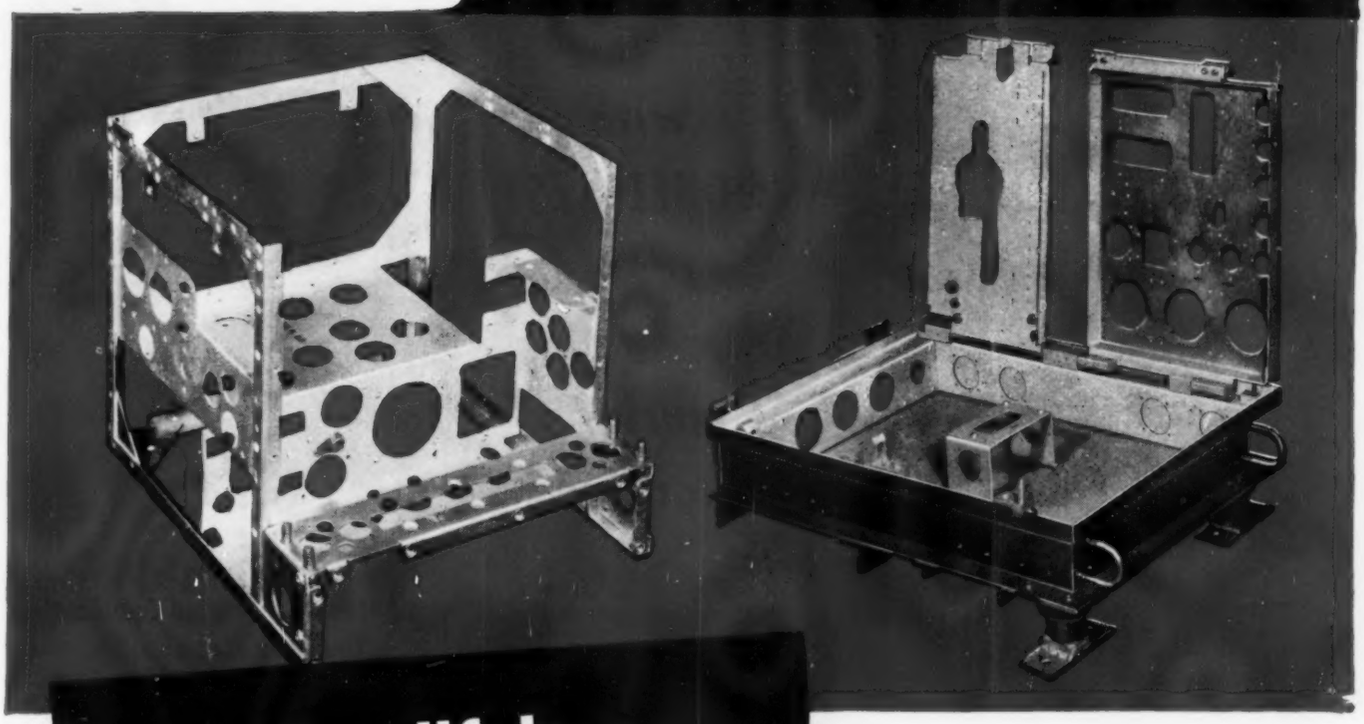


Starrett Micrometers Finished In Non-Reflecting Satin Chrome

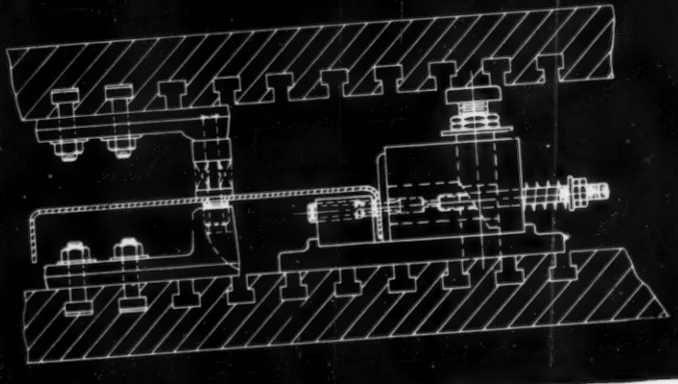
The friction-thimble and block-frame micrometers made by L. S. Starrett Co., Athol, Mass., are now offered with a satin-chrome finish. This finish is produced by a special process which results in a glare-free non-reflecting surface against which markings and graduations stand out.

The satin-chrome finish is said to be resistant to stains and corrosion. Other features of the Starrett micrometers include the mirror-like finish on faces of anvils and spindles and the decimal equivalents of 8ths, 16ths, 32nds. and 64ths marked on the frame.

WHISTLER ADJUSTABLE DIES . . USED BY OVER 1000 MANUFACTURERS



Simplifying Complicated Piercing Operations . . .



LEADING manufacturers find it fast, simple, accurate, and economical to use Whistler adjustable dies for the tough jobs. Complicated patterns can be set up quickly. It's easy to change hole arrangements too . . . without waiting and at no extra die cost. New HU-50 units, that pierce at 90° angle, can be used in conjunction with standard perforating equipment. Fewer press operations are necessary.

Savings, through continued re-use of the same dies in different arrangements on many jobs, are most important.

Whistler adjustable dies can be used in practically every type press. Standard sizes of punches and dies up to 3″ are available in a hurry. Only a few days are necessary to get special shapes made to order.

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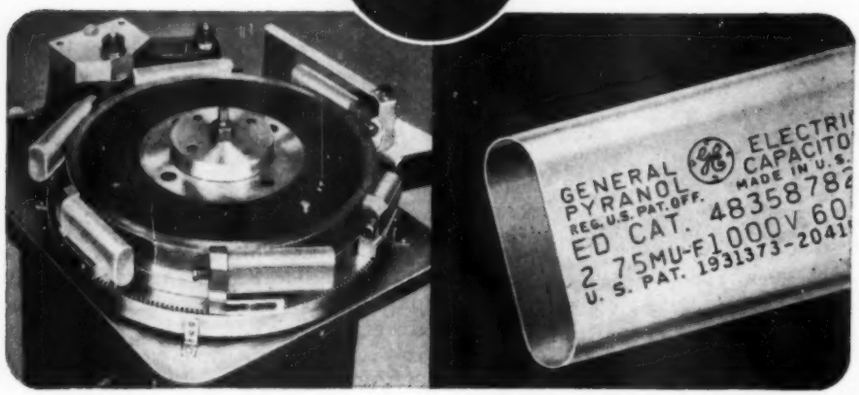
758 Military Road Buffalo 17, N. Y.

HU-50 Perforating unit used in conjuction with standard Whistler adjustable dies on the same job.

For more details on this modern way to speed production and save money, write for your copies of the Whistler catalogs.

See us at Booth 1502 National Metal Exposition— October 25 to 29—Convention Hall—Philadelphia.

now MARK metal or plastic parts faster better cheaper with NOBLEWEST rapid production marking machines



Are you using modern methods and equipment for marking the products you manufacture? Right now Noblewest Rapid Production Marking Machines are stepping up production and saving money for leading manufacturers in many industries. For example, Model No. 286, shown above is tooled for marking GE capacitors. The inscription, shown at right, being permanently *rolled in,* lasts as long as the product itself. Noblewest equipment can be used for marking metal, plastic, hard rubber, etc. Marking speeds are practically unlimited. Every Noblewest Marking Machine is engineered to meet your specific requirements, and backed by the skill, experience and facilities of the world's leading manufacturer or rapid production marking equipment. Whatever your marking problem, Noblewest engineers will be glad to make time and money saving recommendations without obligation to you. A copy of our new catalog on Modern Marking Methods will be sent upon request. Write to Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

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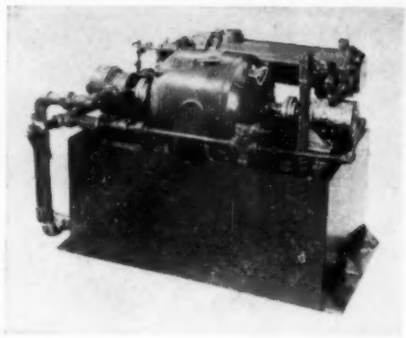

Dual Pumping Units by Universal Available in Varied Combinations

The Universal Hydraulic Machinery Co., 285 Hudson St., New York 13, N. Y., offers dual pumping units available in all sizes and combinations from 12-40 gpm., at 250 psi., and from up 1.25 to 5 gpm. up to 5000 psi. Pumping units are mounted on a reservoir with relief and unloading valves, and double-end motors from 3 to 15 hp. with an oil cooler.

GRC Zinc-Alloy Tubular Rivets For Machine, Hand Applications

Gries Reproducer Corp., 780 East 133rd St., New York 54, N. Y. offers zinc-alloy tubular rivets. The corrosion-resistant rivets are suitable for applications not requiring the maximum strength of steel or brass, and possess riveting properties for both machine and hand applications.

Rivets are available in oval-head sizes from 1/16 to 9/64 in. in diameter, and flat countersunk heads in 9/64-in. size. The semi-tubular type are made in 1/16- to ⅛-in. sizes, and the 9/64-in. size is available in both semi-tubular and full-tubular types. Lengths up to 10/16 in. are available.

Hydro-Solv A Sludge, Gum Solvent Added to Regular Hydraulic Oils

A sludge and gum solvent is offered by the Swan-Finch Oil Corporation, 1243 Avenue of the Americas, New York, N. Y. Called the "Hydro-Solv A," the product can be added to regular hydraulic oils to overcome sluggish operation caused by contaminants. After the recommended 100 to 150 working hours allowed for the treatment, the system should be drained and new oil put in. Gum and

This prescription raised production 50%

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It was a Carboloy engineer who turned the trick. Here's the story:

On installing a new boring machine recently, a small plant in Pennsylvania was sadly disappointed to get no better production from it than they had from the old one. So they called in a Carboloy engineer.

Now? Thanks to his suggestions, the new machine is turning out half again as many pieces—twelve cast-iron wheels an hour instead of the previous eight.

Why was he able to help them? Here's the reason: Carboloy engineers spend most of their time working with Carboloy Cemented Carbides. They've come up against almost every type of carbide problem you can imagine, in their time. They're experts—specialists in carbides.

Try this prescription yourself!

You, too, can back up the intimate knowledge of your own production men with this specialized "know-how" of Carboloy engineers. They can bring to your plant a broad experience in obtaining maximum results with carbides.

Slight changes in tool design, speeds or feeds, grinding, or tool handling often effect far reaching economies and increases in out-put.

Together, your engineers and our Carboloy specialists can form a team nothing can stop. Together they can use carbides to cure many of your production ills.

Ask for your Carboloy engineer

Your Carboloy engineer will be glad to help you with your carbide problems; or in the selection of the most economical tooling from any of Carboloy's 600 standard tools and blanks, or special Carboloy-tipped tools made by more than 150 tool manufacturers.

Why not call your Carboloy engineer? Or write us direct: Carboloy Company, Inc., 11149 E. 8 Mile Blvd., Detroit 32, Michigan.

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CEMENTED CARBIDE

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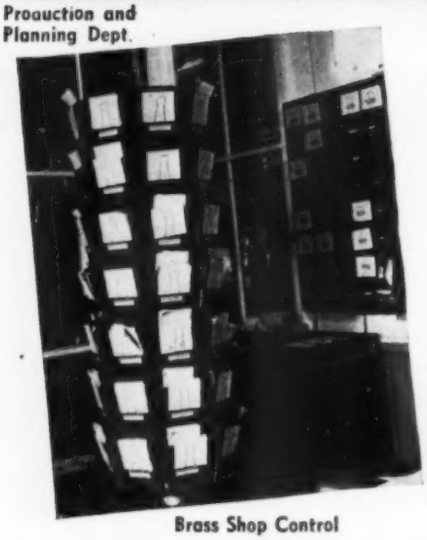
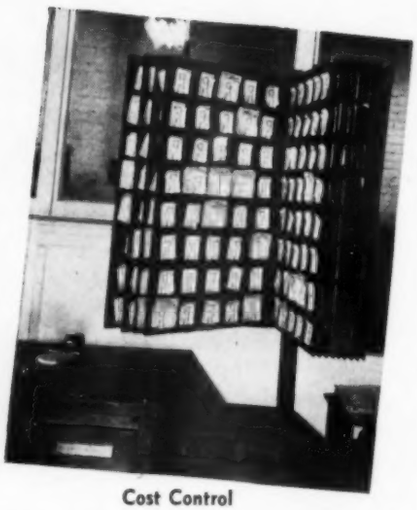


Brass Shop Control



Cost Control

How MASON-NEILAN Simplified Production and Cost Control

Mason-Neilan Regulator Co., Boston specialist in pressure, temperature and liquid level control equipment, simplified successfully more than eleven years ago with McCaskey "One-Writing and Visible Filing" systems. Their objective was to "hold down costs without sacrificing high quality standards."

Their controls include: the machine load for all machines at all times; the delivery of material to machines; the progress of each production order and the number of pieces produced daily compared with standards and schedules; the daily cost status of a thousand jobs in process; detailed costs almost immediately after their completion.

Three-copy time tickets made at "one-writing" provide identical data from the shop to three control divisions where they are immediately visualized on McCaskey Planning Boards for quick reference by planning and cost clerks. Their systems are stream-lined for speedy, effective action.

Write for a demonstration and suggestions for an application to your particular needs—or send for a copy of "The ABC's of Production Control" and other descriptive folders.

McCaskey INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • TOOLS • COSTS • PAYROLL

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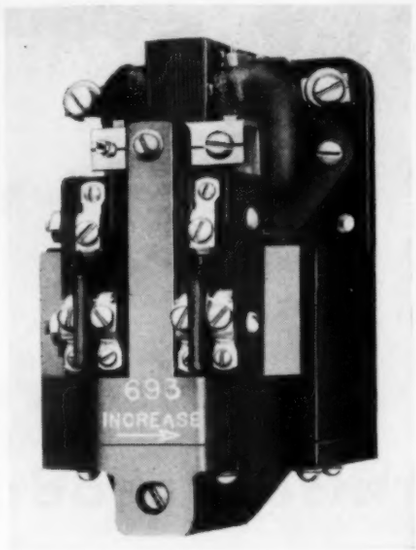
sludge, either in solution or suspension, is removed with the dirty oil. The product is non-corrosive and will not affect fine surface finishes.



Cutler-Hammer Pneumatic Timer Ranges from 0.3 sec. to 3 min.

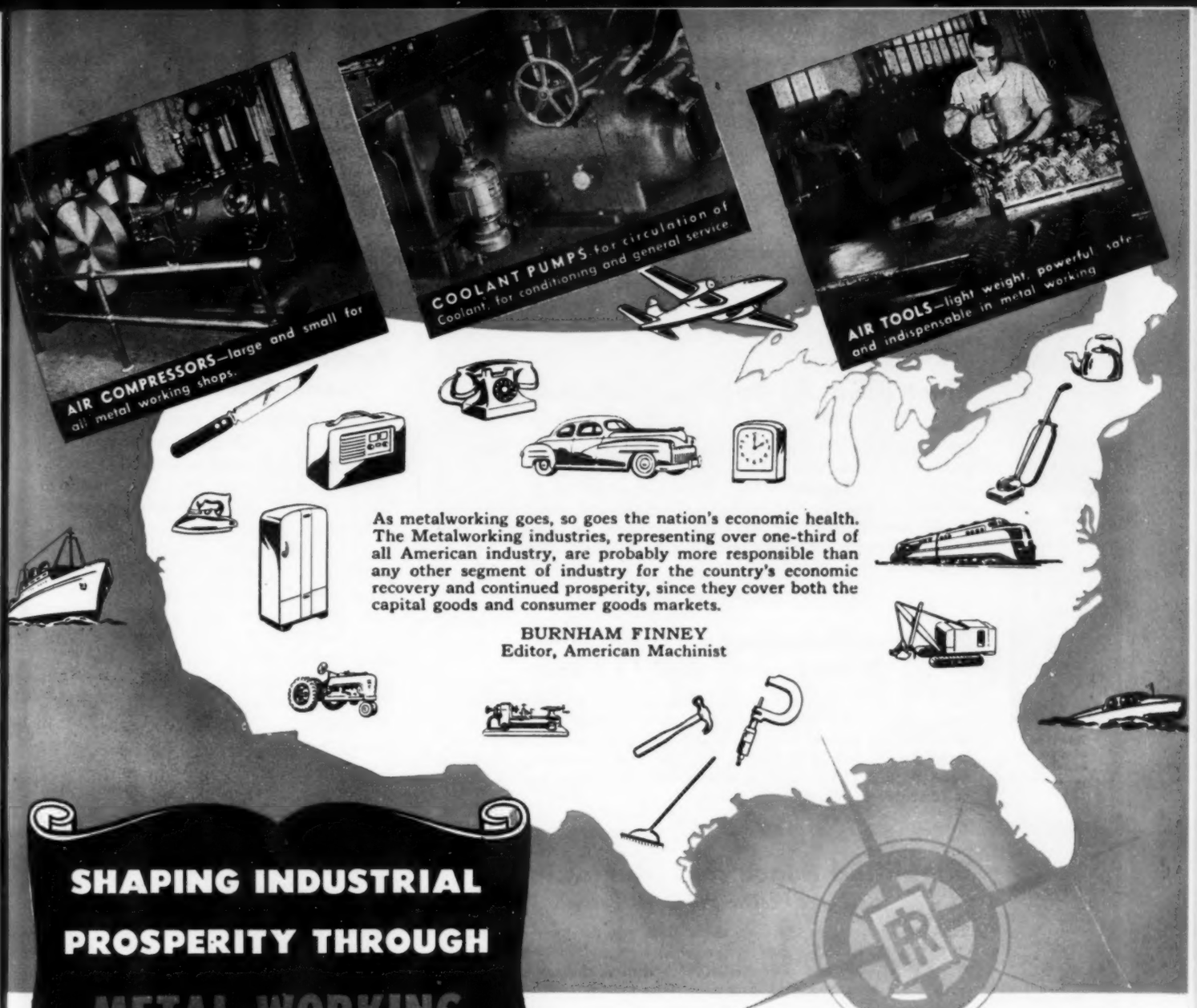
An ac. pneumatic timer, designed for use on machine tools, conveyors, or automatic-processing equipment, is offered by Cutler-Hammer, Inc., 205 North 12th St., Milwaukee, Wis. The timer is 2¾ in. wide by 7⅜ in. high. Eight turns of the screw on the front of the unit gives the entire timing range from 0.3 sec. to 3 min. The timer is available either with 1 or 2 timing steps. The two steps are independently adjustable over the entire range.

Liquid Wax by Johnson Offered As Lubricant During Impact Extrusion

A liquid wax for use as a lubricant in the manufacture of metal items by the impact-extrusion process is announced by S. C. Johnson & Son, Inc., Racine, Wis. Listed as Johnson's LW No. 20 wax, it can be applied to slugs before extrusion by dipping or tumbling. It is said to remain in place under the terrific heat and not to dissipate itself, thus cutting the number of rejects due to scoring. The wax provides a dry finish and will not turn rancid.

Ampco-Trode 10 Bare Bronze Wire Made for Submerged-Arc Welding

A bronze bare wire for submerged arc-welding is offered by Ampco Metal, Inc., 1745 South 28th St., Mil-


AIR COMPRESSORS—large and small for all metal working shops.
COOLANT PUMPS—for circulation of Coolant, for conditioning and general service.
AIR TOOLS—light weight, powerful safe and indispensable in metal working

As metalworking goes, so goes the nation's economic health. The Metalworking industries, representing over one-third of all American industry, are probably more responsible than any other segment of industry for the country's economic recovery and continued prosperity, since they cover both the capital goods and consumer goods markets.

BURNHAM FINNEY
Editor, American Machinist

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IN OUR COUNTRY there is a vast variety and quantity of raw materials . . . and men and women with the inventive genius, resourcefulness and work-together ability to make the most of our good fortune. For instance, what we make with metals is a very important chapter in the story of American prosperity.

No one questioned the might of our Metal Working Industry during the war, when it accounted for nearly fifty per cent of our unequalled manufacturing activity. And, we must not forget that during normal times it represents approximately thirty per cent of such activity. In its 28,000 plants, employing nearly 4,000,000 wage-earners and billions of dollars of modern machinery are fabricated all metal products from giant ships to the most delicate instruments and tools.

As a manufacturer of efficient, modern machinery Ingersoll-Rand is a part of this great Metal Working Industry. I-R products—made of metal—are used throughout the industry. Air compressors and ingenious air tools account for many of the improvements in methods. Centrifugal pumps are used in power plants, pumping stations, shops and mills, and for circulating the coolant liquids for machine tools . . . Turbo-blowers furnish combustion air for blast furnaces, converters and heating equipment . . . Diesel engines furnish economical power.

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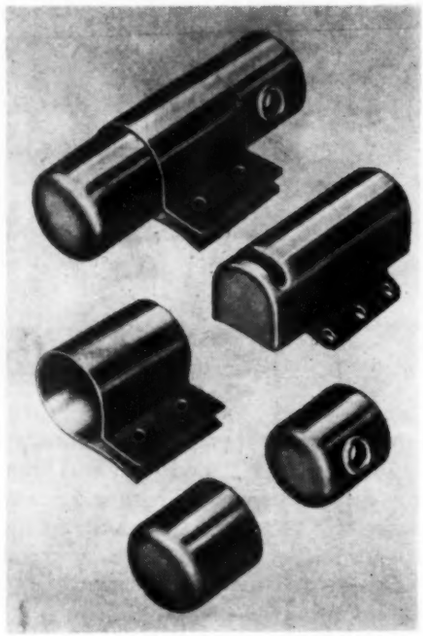
waukee, Wis. Listed as Ampco-Trode 10 bare wire, it is produced for use in steel mills and other applications where it is more economical to apply deposits of this grade of Ampco-Trode over large areas by an automatic process in preference to hand welding. It is supplied in coils in ⅛-in. and 3/16-in. diameter sizes. The finished wrapped coils have a 22-in. I.D., wound left hand to turn off a vertical reel counter-clockwise.

Electric MV High-Speed Steels Contain Chromium, No Tungsten

A line of high-speed steels called the Electric MV high-speed steel group, is offered by the Latrobe Electric Steel Co., Latrobe, Pa. The line is distinguished by its chromium, molybdenum, and vanadium content with no tungsten present in the steels. These steels are said to be adaptable for applications which do not require the full properties of tungsten and molybdenum-tungsten high-speed steels. Applications included are small drills and reamers, thread-chasers, taps, and similar products.



Motor-Capacitor Housing Offered With a Single Mounting Bracket

The Aerovox Corporation, New Bedford, Mass., announces its line of motor-capacitor hardware. A housing with a single mounting bracket, the mounting bracket that fits around the usual round capacitor, and the top- and bottom-end caps, are offered, in addition to the motor-capacitor housing with mounting lugs.

Silicon-Bronze Fire Extinguishers By Alfco Are Resistance-Welded

Resistance-welded silicon bronze fire extinguishers with a 2½-gal. capacity are offered by American-LaFrance-Foamite Corp., Elmira, N. Y. Extinguishers replace the riveted and copper-fabricated unit of the same capacity. The line includes soda-acid; foam; plain water; and anti-freeze water type. A transparent-plastic nozzle provides clear vision of the passage-way and greater resistance to accidental blows.

Johnson Water-Emulsion Wax Is a Rust-Inhibiting Coating

A water-emulsion wax, used as a rust-inhibiting coating for metals, is offered by S. C. Johnson & Son, Inc., Racine, Wis. Known as Johnson's rust-inhibiting wax No. 1568, it is applied by dipping, spraying, wiping or flow-coating. The emulsion forms a dry wax plating on the metal part that checks corrosion. It is non-flammable and non-toxic and gives coverage between 2500 and 3000 sq.ft. per gal. It can be removed by degreasing.

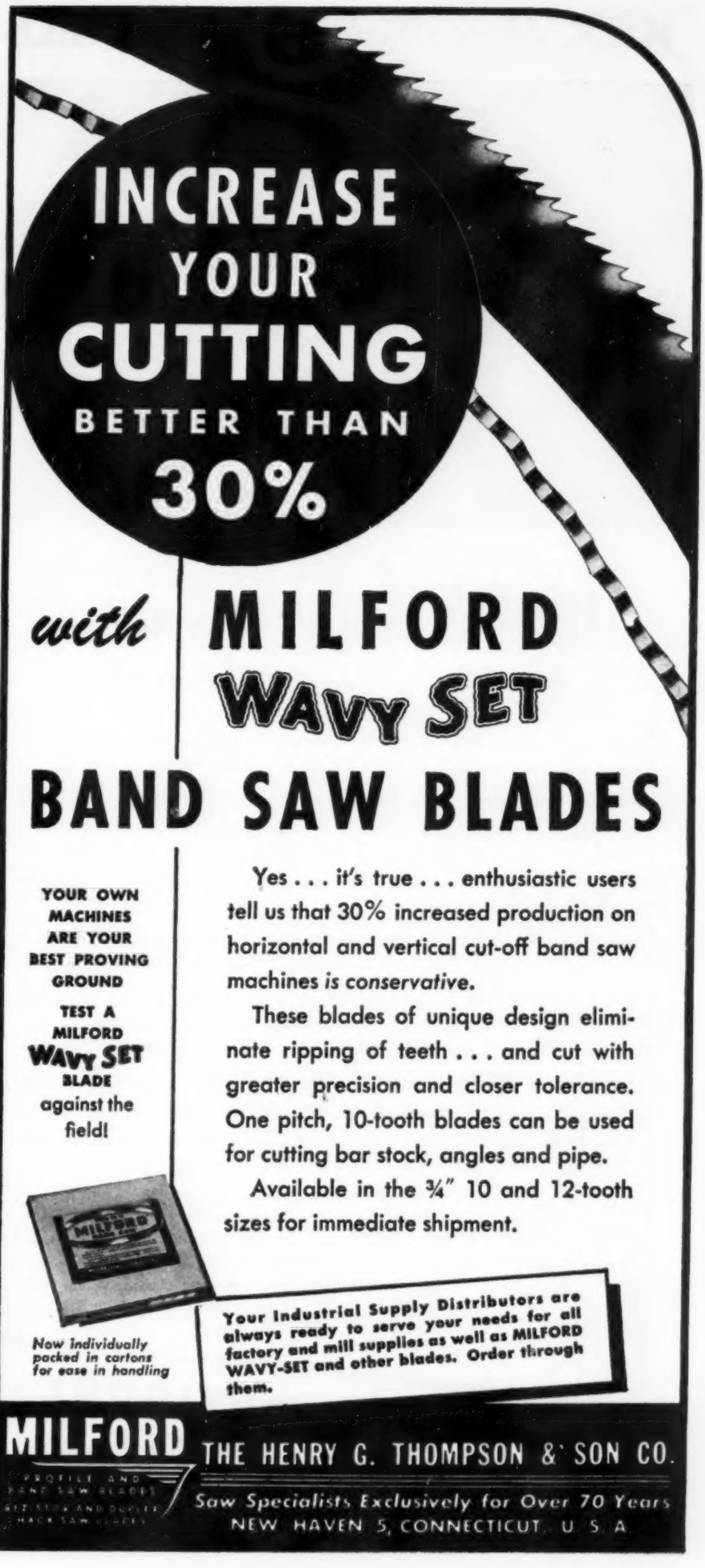
Enthonite No. 101 Liquid Plastic Offered as Plating-Rack Coating

A liquid-plastic plating-rack coating is marketed by Enthone, Inc., 442 Elm St., Dept. AM, New Haven, Conn. Called Enthonite 101, the material is supplied as a viscous liquid containing 100 percent solids, which is applied by dipping to produce coatings varying in thickness from ⅛ to ¼ in.

The material is applied over a primer coat and is baked at temperatures of 350 F. or higher for a short period of time. All drippings can be reclaimed and reused. The coatings are said to have high resistance to all types of inorganic solutions, particularly plating solutions and including chromium-plating solutions. A glossy surface is produced. The tough resilient coating produced is said not to chip with rough abuse of the plating rack.

Myler Plastic Cold-Molding Powder Requires No Preheating, Finishing

Gladite, a plastic cold-molding powder is announced by Myler Plastic Corp., 92 Bishop St., Jersey City 4, N. J. Gladite, a free-flowing powder, molds in all colors without preheat-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"KEX" Rings bell with National Cash Register's Dayton, Ohio plant

KNOWING where to keep money is this company's business. Which is why it has not hesitated to install KEX Industrial Wiping Towels.

Its Top Management, as in the case of hundreds of others using KEX National Service, like it because it is so economical . . . so easily controlled to meet changing plant conditions. It likes KEX National Service, too, because it keeps everybody happy all the way down the line. For example:

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Follow the lead of industrial leaders who overlook no opportunity to keep operating costs down—and efficiency up. GO KEX.

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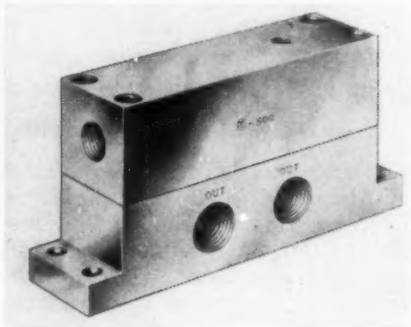
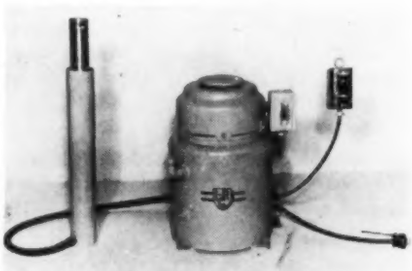
ing, preforming or after-baking and eliminates finishing. Parts can be cold-molded in colors said to be fast.

The physical properties can be varied by formula to adapt it to specific product uses. Gladite can be used on either rotary, single-stroke, or hydraulic presses. Parts can be turned out at speeds as high as 30,000 small units per press per hr. Each piece as it comes from the press has a lustrous surface. Grinding, buffing, and polishing are eliminated.



THREE- FOUR-WAY AIR-CONTROL VALVE for air cylinders is offered by the Valley Tool Co., 5515 E. Slauson Ave., Los Angeles 22, Calif. Called the Master air-control valve, the balance piston does not require a lapped fit. It is used to actuate the molded oil-resistant slide valve back and forth. Various applications can be made by adding accessories for hand and foot operation with neutral, reciprocating solenoid, or remote poppet. Sizes from ¼- to 1-in. pipe size are available



Power-Operated Hydraulic Pump Develops 1000-psi. Pressure

Lyon-Raymond Corp., 5816 Madison St., Greene, N. Y., offered a power-operated hydraulic pump that will deliver 1½ gpm. of oil, and develop a pressure of 1000 psi. A flange-mounted motor is placed directly on top of the oil reservoir. The reservoir has an oil capacity of 2½ gal. The entire pump assembly is 18¼ in. high and 12½ in. in diameter.

A ¾-hp. ac. motor is used, and is

available for 110-, 220-, or 440-v. service. The valves use an open-center arrangement which permits the motor to idle except when the unit is pumping oil to the pressure line.

The standard unit is furnished with a three-way valve for operating a single-action hydraulic cylinder. Four-way valves for operating double-action cylinders are available.

Clark Automotive Foot Control For Electric Carloader Fork Truck

An automotive-type foot control is introduced by the Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich., for the Clark electric Carloader fork trucks. The control is placed for left-foot operation and has four control positions for different speeds. The driver's right foot operates the brake. Brake operation automatically cuts off power from the battery in 2nd, 3rd and 4th speeds. Inching is accomplished in the first point of power.

Line of Steel Dipping Baskets Covered with Semi-Hard Rubber

A line of insulated baskets for dipping, pickling, and general use in submerging parts in corrosive solutions has been developed by Automotive Rubber Co., 8801 Epworth Blvd., Detroit 4, Mich. The baskets are fabricated of heavy-gage, reinforced, perforated steel with welded joints, perforated steel with ⅛-in. thick, semi-hard pure rubber.

All faces of the hole are covered with rubber, small perforations being filled solid and drilled out. Four sizes of perforations are offered with finished-hole sizes of ⅛, ¼, ½, and ¾ in. Four sizes of baskets are offered in each hole size: 12-in. dia. by 12-in. depth, 10x10, 8x8, and 6x6 in. Rigid bails, welded to the body, are also rubber covered.

ROUND TABLE *Discussion*

EASE IN OR BREAK IN?

One's own early experiences would recommend the policy of a pleasant introduction rather than that of pitchforking a new hand into an un-

OUT OUR WAY
HELP HIM THERE--I'LL GET TH'--A STRETCHER--NO, I MEAN--I'LL GET SOMETHING!
FUNNIEST FALL I EVER SEEN--BOY, I FEEL SORRY FOR TH' POOR SWEEPER!
YES, SIR! FIRST TIME HE FORGOT TO PUT DOWN SOL-SPEEDI-DRI--AND LOOK WHAT HAPPENED!
J.R.WILLIAMS
THE FALL OF THE YEAR
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Quality makes SOL-SPEEDI-DRI the leader

SOL-SPEEDI-DRI is industry's No. 1 absorbent for all liquids. Spread over dangerous, oil-soaked floors, it provides a slip-proof carpet—cuts down on accidents caused by slips and falls. More SOL-SPEEDI-DRI is used in plants and shops all over the country than any other product of similar nature. The reason? There are many, but the big one is *quality*—constant, unvarying quality from one pound of SOL-SPEEDI-DRI to the next.

SOL-SPEEDI-DRI is mined and processed by people who are specialists in the business. Only nature's finest product is used, and this raw material is processed under stringent laboratory control into the finished product. SOL-SPEEDI-DRI comes to you in special weather-proofed bags, insuring factory-fresh material at time of use. That's why you can count on SOL-SPEEDI-DRI to do *more* work, to give you *more* for your money.

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MATERIAL HANDLING *News*

"King's size for usefulness, Pint-size in cost"

ELEC-CLIPPER

is the versatile electric battery-powered fork truck for that multitude of handling jobs defined as "loads up to 2,000 pounds"

Orderly tiering of palletized cartons to the ceiling or cold storage rooms is routine for the Elec-Clipper

Unloading material from a delivery truck with the Elec-Clipper cuts the truck's standing time, simplifies checking of shipments, speeds the movement of material

Hustling unit loads from the warehouse and quick assembly of shipments by means of the Elec-Clipper cut handling costs to the minimum

Potent combination of versatile utility and attractively small cost, Clark's Elec-Clipper has done an exceptional job for industry in handling materials weighing up to a ton. In the many branches of the food industry, and particularly in wholesale distribution outlets; in foundries and metal working shops, automobile plants, railway storehouses and freight depots; in truckers' freight stations and warehouses of all kinds: in all these and many other varied installations, electric battery-powered Clark Clippers enjoy admiration and respect.

With 124-inch lift on the standard high-lift model, and over-all height of only 83 inches with forks lowered, the Elec-Clipper moves comfortably and safely under 7-foot clearances, and does high tiering with amazing ease.

Finally, it costs less—a clinching benefit: less in initial investment, less to maintain, less to operate—by testimony of delighted users. That benefit is a natural result of Clark's unrivaled automotive experience and of Clark's own quantity production of nearly all component parts. It's a better machine—husky, dependable, economical—*because Clark builds it.*

To get a wholly objective survey of materials handling operations and needs in your business, talk to a Clark field representative—a competent man whose recommendations are unbiased because *Clark builds both* types of machine, gas-powered and electric battery-powered. As basic "good business" CONSULT CLARK.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

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known and not always friendly surroundings.

The youth who has just completed his apprenticeship often finds things in a new shop exceedingly difficult. The position is not unlike getting out of a train at a station in a strange town and having to find one's destination without directions.

Even to an older man, to start on a night shift in this manner is not easy. There are fewer foremen and less secondary labor, thus the inquiries of the new man become a nuisance. After seeking tools, drawings, and gages all night, many a man has gone home in the morning dispirited, if not soured.

The practice of taking in hand a new man by putting him to work near an old hand who can tell him where and how to get things, is always appreciated, leads to some lasting friendships, and is good for the firm. The new man starts out without any kind of personal indebtedness and values the introduction.

Anyway, why not be as courteous in a shop as at home. Not to introduce people is boorish.

J. E. Powell
Lincoln, England

•

Regardless of how the boys feel in any organization, the boss is hired by the next ranking superior or group of supervisors, and he is also fired by the same personnel.

It always gives the retiring supervisor a glad feeling when a show of favorable reaction as to his administration reaches him. This could, but probably should not, influence the action taken by higher management.

It is true that many mistakes are made when men are fired, but this holds true whether in the administrative division or among the laboring class. Unfortunately, it is a too frequent occurrence to let a man go simply because he knows too much for the welfare of his superior. This happens fairly frequently in small companies where the competition for the various positions is keen and each man has his eye on the superior who "fathers" the job.

Management cannot allow workers to choose their bosses. This would merely be playing into the hands of unionized labor, and the bosses would soon become union pawns.

Management has yet to learn, however, that it must teach the meaning of industrial peace. The solid company will have rules and policies well established and its men schooled in the administration of these rules. The workers then know what to expect. The boss is not soft, neither is

he always cracking the whip. He administers company policy, not new rules open to debate.

The worst thing that can happen is to issue a company ruling and then make changes and adjustments for each and every situation that arises. This breaks down morale and makes each worker feel that he can get away with an infringement. Open disagreement results; a boss must be replaced; workers will start petitions because the boss was soft, and they realize that a new man may be tough, and so on.

Management, to be successful in eliminating industrial strife. must educate men to pick employees who are suited for the various jobs and to keep everyone well informed of company policies. Then Ed and Al would not have to consider the conditions under discussion, as they would not exist.

Labor has no right to say, except as a sounding board, who should or should not be boss.

Charles D. Townsend
Centralia, Mo.

•

It is common sense that the stranger within the gates should have the path made easy for him the first few days. Before he starts he should be given a list of tools which he is expected to provide. When a new man reports, an introduction to the man in charge of tool-store arrangements and to the chargehand, who in turn will introduce him to the man beside whom he will be working, with a request that the newcomer be shown the ropes, is a good method to keep a man from feeling strange or neglected.

Regarding the quality of work to be handed out to a new "start," the practice of a well-known British Naval factory may provide a good example:

Every prospective new "start" must undergo a test of mechanical ability on the work to which he is accustomed; e.g. a lathe job for a turner, a bench job for a fitter, and so on. In deciding on the quality of the test to be set, due regard is paid to what will ultimately be required of the man and also the claims made by the man in the matter of skill and experience. If he claims to be an experienced turner, capable of screw-cutting to close tolerances, he would probably be given a square, acme or buttress thread to cut with one or more "starts" according to his experience. The prospective new man is required to do the test on his own time and without pay.

For the purpose of the test, every

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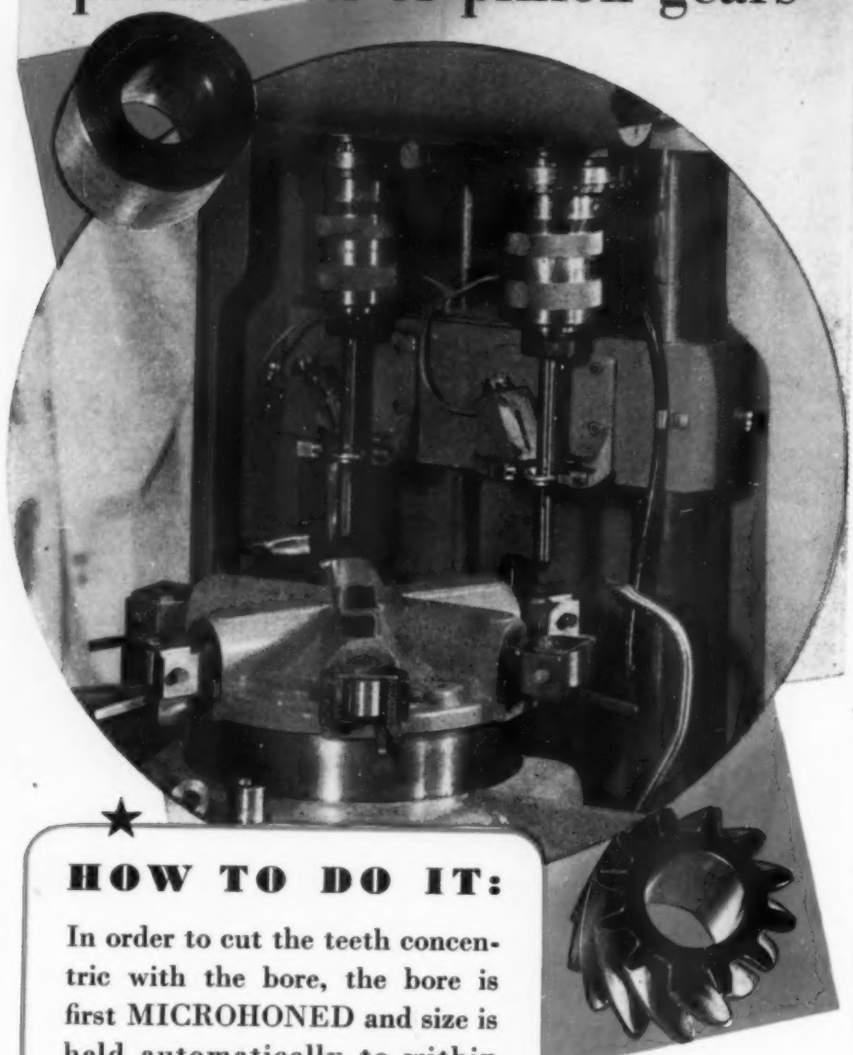

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In order to cut the teeth concentric with the bore, the bore is first MICROHONED and size is held automatically to within .0003". The blanks are pressed on an arbor and the teeth are cut. After heat treating, the bore is again MICROHONED to correct any distortion caused by heat treating and to generate any desired surface finish.

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Micromold Manufacturing Div., Boston Post Road, Guilford, Conn.

facility is accorded and every help given by the foreman in charge. If the man passes, the results of the test are a useful guide to the quality of work which can be safely given to him during the first few weeks of his employment.

Experience proved that the newcomer was not ignored, nor could he feel neglected, for almost every man nearby came along with offers of help in the form of advice and tools, and one of the foreman's chief worries was to limit their good intentions on the principle of "too many cooks . . ."

Here in Scotland, if men are members of their union, they are soon made to feel at ease in their new surroundings, and generally, the smaller their intimate circle in the shops, the greater the output.

C. D. Mackinnon
Lanarkshire, Scotland

•

DEADLINE OR DEAD TIME?

In past years, unless I had been working on a job needed in a hurry, I usually threw out my clutch of effort and coasted up to the stop sign about five minutes or more before quitting time. Obviously, I would pretend to be busy—expending as much energy in doing it as I would have in doing legitimate work—although the boss knew darn well that I was not. In fact, if the truth were known, he was afflicted with the same allergy—'Callitadayus.'

While in theory Al is decidedly wrong in allowing the boys to quit five minutes early, we have to face realities. Only a very few put forth their utmost effort right up to the quitting bell. It's only natural for a man to coast along at the end of the day. It is this variation of the coasting-along period that Al seeks to standardize. There are a few who relax at the sound of the quitting bell—in fact, you'll find an individual occasionally who will work on for some time simply because his interest in the work predominates over his desire to get home to the 'old lady.' Al's scheme is sound psychology at work, successful in its application because he knows his men.

Rather than have the workmen become disorganized in a shop that frazzles at the day's end in no uncertain pattern, he tightens up, paradoxically, by loosening the screws. "I've given you the story boys," he as much as says, "Now get on the ball and let's mean business up to that time."

John Homewood
Ontario, Calif.

BOSS—AND BUST?

Management would be wise not to force an unwanted promotion upon an employee who feels unfavorably toward it. The combination of responsibility and overwork affects different men in various ways. Medical studies have indicated the effect of emotions, tensions, and overwork upon the body. This is evidenced in some executives, who always appear to be on the verge of a nervous breakdown, while others develop ulcers directly attributable to the tensions and overwork involved in being boss.

For some men the knock of opportunity is the herald of the possible shortening of life and the beginning of unhappiness. The man who knows his physical and mental capacities and can judge the probable effect of increased responsibilities and work is using intelligence in evaluating a problem that he can alone answer.

It is better to retain the services of a good mechanic than do him the disservice of forcing unwanted responsibility upon him, with the possible deleterious effect on his health and value to the organization.

All men are created equal, but not all men are molded in the mental, emotional and physical frame that produces good executives.

Harry Kaufman
Phil., Pa.

•

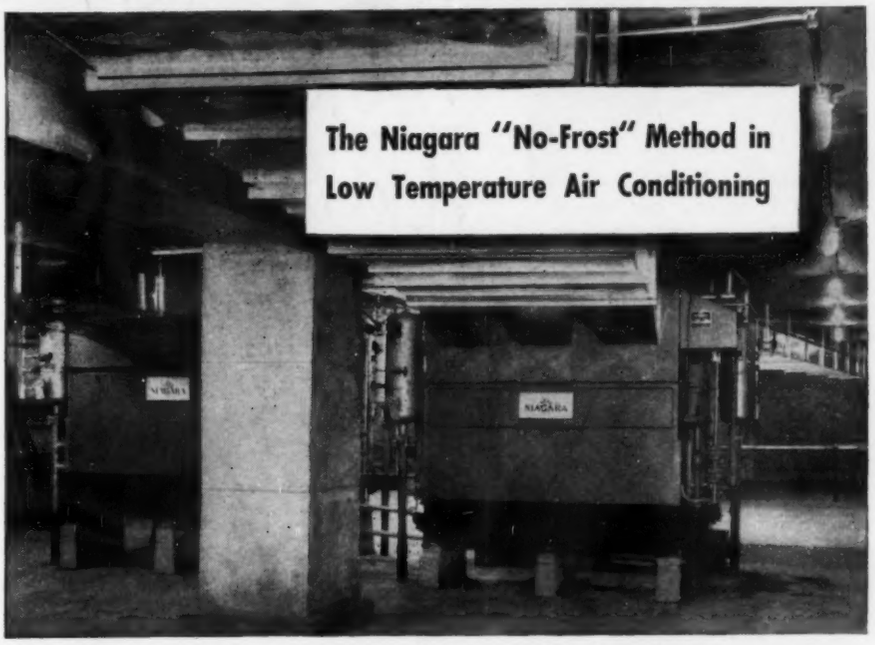
You'll often run across a Dawson in our business. If you study the man closely, you'll find that he follows the boss with discerning eyes, and proceeds along with his work with a song in his heart. "Now who in hell wants to be an executive?" he soliloquizes as he works his file back and forth across the work. It would be murder in the first degree to put a man like Dawson on a job of troublesome responsibility. The wrath of the big boss would split the heavens with a flash of indignation were one of His own to be incarcerated in the dungeon of industrial woes.

But take Bill Wrinklebrow. He was hungry for power from the first day he started in on his milk bottle. The industrious lad finally wound up as a foreman in a plant, spent his extra money on tablets to relieve his constant indigestion, and finally cracked up under his driving enthusiasm.

Cogitate on the difference between Dawson's well organized mentality, where the quitting bell meant just that, and the Bill species which hangs on and worries.

No, Ed, when looking for an assistant, let Dawson and the others

Making or Holding Products Uniform



High Precision Industrial Air Conditioning with extremely dry atmospheres (or with high relative humidities) at low temperatures.

● Specializing for thirty years in the more difficult problems of air conditioning for industrial processes, this Company has developed a group of units that make it easier and less expensive for you to get the particular air conditioning benefits you may need for your special process, or to overcome some obstacle of climate or condition that is interrupting your production or causing loss from rejected parts or materials.

The Niagara "No-Frost" Method, for example, has been used to create temperatures as low as -90°F. in cold test rooms, and to provide air with only 1 gr. of moisture per lb. for special processing.

The Niagara Type "A" Air Conditioner creates any condition of temperature and humidity for a test or process, and if wanted, creates different conditions in different rooms simultaneously.

Some of the industrial applications of these units: internal combustion engines, motors and air craft, super-chargers and carburetors, gas cooling and controlled atmosphere process, film, plastics, fiber, rubber and adhesives control, biological processing such as penicillin, and yeast.

Write for a Niagara Blower Bulletin on a subject which interests you, or for the address of the nearest Niagara Field Engineer.

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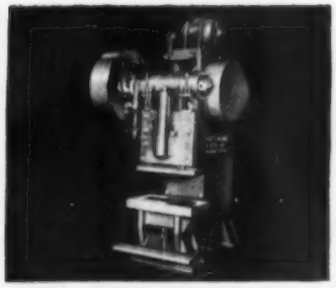
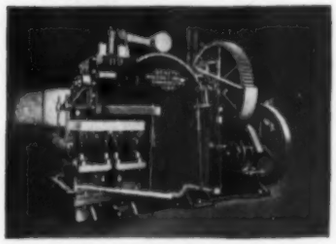
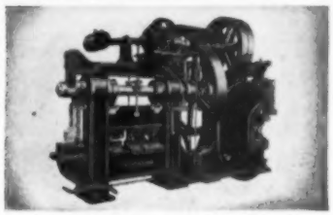


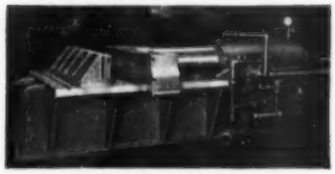
BEATTY Single End Punch available in capacities up to 200 ton.



BEATTY No. 11-B Heavy Duty Punch for production tooling and use with BEATTY Spacing Table.

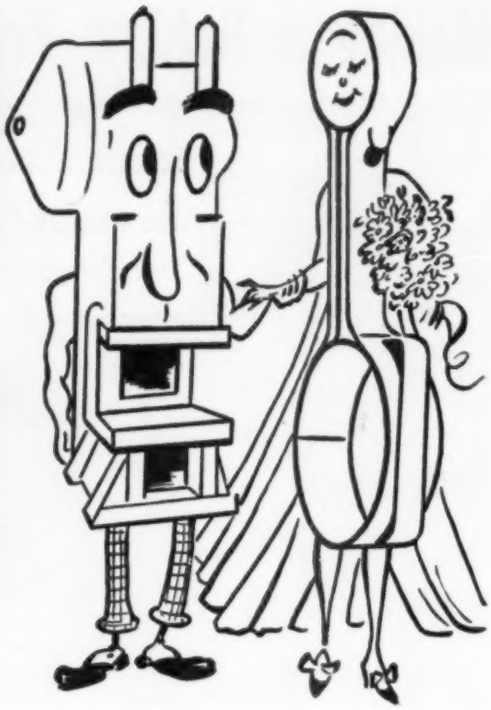


BEATTY Co-Pun-Shear — one unit does coping, punching, shearing.



BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.

BEATTY 250-ton Gap Type Press for forming, bending, flanging, pressing.



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Fast, low-cost production today demands machines correctly designed, correctly tooled for the specific job to be done. It *demands perfect mating* of machine to job, and this calls for the best engineering experience available to you. Here is where BEATTY ENGINEERING comes in. We know there is a BETTER way to do most production jobs. Our broad experience in finding that better way for so many companies is assurance that we can contribute to the solution of your problems. Write or phone us about your needs. Your best insurance for fast, quality production at a competitive cost is a BEATTY machine engineered to your specific needs.

HYDRAULIC HEAVY METAL WORKING EQUIPMENT

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HAMMOND, INDIANA

like him remain happy workmen. Pluck not the fragrant rose that faces the glorious sunshine of a happy and contented life.

John Homewood
Ontario, Calif.

•

Unfortunately there is altogether too much truth in Al's defense of the fellow who would rather "live" than be a foreman.

Values of work have changed. So many people are being hoisted to new standards of living on the bootstraps of unionism and the mass production of former luxury items, that the mere possession of worldly goods no longer is indicative of success. By the same token, taxes are eliminating sagas or "rags to riches." A growing awareness is dawning that we have been so busy achieving success, we have neither the taste nor the power to assimilate it.

It is hardly fair to classify as "lazy" one whose aspirations do not correspond to the primary definition of ambition—"inordinate desire of power or distinction for its own sake."

Instead of criticism for such an attitude, a little imitation might be good for all of us. "What is this life if full of care we have no time to stand and stare."

A. M. Elliott
LeRoy, N. Y.

•

SHOULD SUGGESTIONS BE SCREENED?

A definite company policy is needed to have a successful suggestion plan in any plant: one that allows the worker to use the secret suggestion box, but also encourages the foreman to stimulate ideas in his workmen, is ideal.

Every foreman should be proud of having men who are capable of working out new ideas. These are the men that he can look to when he needs leaders in his department. He should be ready to help them work out their ideas, if they ask for assistance, but should stay in the background and not force his ideas on them or seek to screen their ideas if they do not need or want help.

Suggestions when accepted for use should be announced on the bulletin boards and in factory publications with the amount of the award given. This acts as a stimulus to other workers. The foreman should know who the suggestors are, as this affords him the opportunity for a word of praise, which is always wel-

come to any man—and anywhere.

In order to gain full support of the foreman, an annual reward based on the awards from his department could be given, with special awards to the foreman and assistant foremen whose department has the best record.

Full participation will encourage more suggestions, and workable suggestions reduce costs.

F. M. Pasco
New Britain, Conn.

•

Suggestions should go directly from the parties who make them to suggestion headquarters.

There is no place in the world where petty jealousies stick out more than they do in a shop. Some foremen are as petty in their notions as it is possible for a human being to be and vent their spleen upon the men who are in disfavor with them. On the other hand, there are foremen who are interested in their men and their men's interests to the extent that they will help in cases where suggestions are intended for suggestion headquarters, but this is not the general rule.

An apprentice said to his foreman, "George, I think . . . ."

And George interrupted, "We don't pay you to think; we pay you to work." Whereupon a discouraged boy slunk away and back to his job. Many a boy has quit learning a good trade because of the handling he received from his foreman.

There are many instances that could be cited of a similar nature in which intelligent boys with good ideas have become discouraged, which proves that the general run of foremen should be kept away from the suggestion box. In this way the chances for recognition of ability are less in danger.

In one company, where bonuses are paid for good suggestions, a form letter is enclosed in the pay envelope telling a man that if he has tried and failed, to try again for a prize, for they are always looking ahead to improve their methods.

With this in mind, Al appears to be on the right side of the question.

F. H. Stebbins
Worcester, N. Y.

•

The private suggestion box reviewed by an impartial employee, executive, or committee is preferred.

A man walking around the shop with an idea in his head is a liability to the employer, because he is not concentrating on his present task and because the employer is losing

SEE
chipping and wear on these blades after 8 CUTS — no flywheel used with cutter.
SEE
sharp cutting edges on these blades after 92 CUTS — Lovejoy flywheel used with cutter.

LOVEJOY FLYWHEELS

These are identical Lovejoy Type "A" Face Milling Cutters tested with identical cuts on the same steel. The picture speaks for itself—it pays to use Lovejoy Flywheels on steel jobs to increase blade life, to get longer runs between grinds, to reduce H. P. requirements, to improve finish, to reduce work spoilage. Write today for Lovejoy Flywheel folder, and ask for detailed engineering help on any of your specific milling problems. There is no obligation.

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SPRINGFIELD, VERMONT

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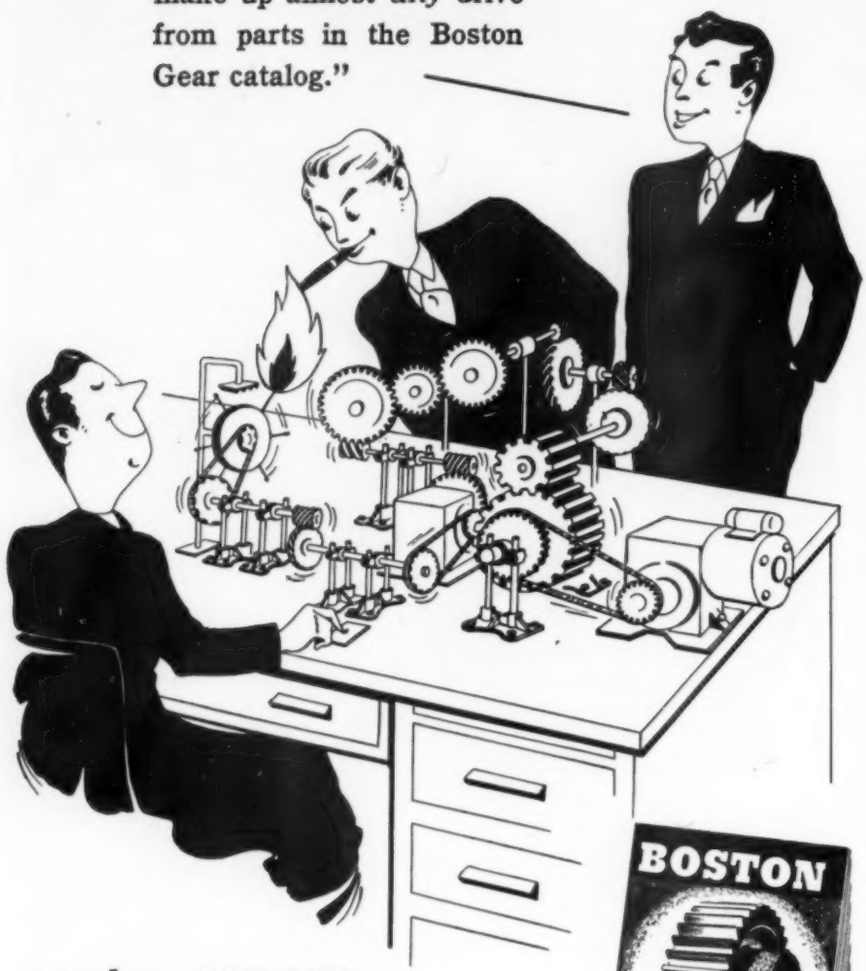
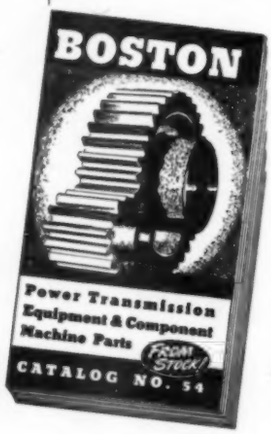
Lovejoy recently announced an unusual negative rake carbide tipped blade, No. 50-18, for cast iron and steel. It has −5° radial rake and 15° axial rake. It can be used in any Lovejoy Type "A" housing ever made. It shears the stock out at terrific speed and gives marvelous work finish, yet requires low H.P. Users are loud in their praise of this new blade. Write for detailed information on this new cost-saver.

"Joe was right—you can make up almost *any* drive from parts in the Boston Gear catalog."





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the benefit of the idea, should it be a good one. Once a man puts his suggestion on paper, his mind sheds a burden. If he knows someone is going to read his paper with the intention of using the idea if practical, he feels an inner glow. When he is informed that his idea is being considered, he swells with pride, and yet if it is rejected, he will be content with a reasonable explanation and will try again.

This same man might hesitate to discuss this idea with the foreman for various reasons: he might feel that the foreman is too busy or that he might not appreciate the suggestion; the foreman might be too critical and discourage the man. Many suggestions turned down by foremen are accepted by other superiors.

An acknowledgment of suggestions should be sent privately to the suggestor, informing him one way or the other about his suggestion.

Frank J. Zarnowski
Rutherford, N. J.

•

The immediate supervisor of the suggestor should be the last in line to make any comment on an idea. The exception, of course, is where the supervisor also happens to be the final boss.

To a foreman or squad boss, well indoctrinated in the running of his department, a suggestion may be regarded as interference with established shop routine, a questioning of his ability, or worse, as a usurpation of his authority. In such cases, the suggestion may be disregarded completely or given the kind of criticism which both stops the idea and the suggestor from making further contributions. Where supervisors are in charge of routine work, there is further danger of unwillingness to change to something new and untried, unless prodded from above. Should a suggestion employ new processes, the supervisor may not be willing to expose his ignorance by consulting others.

A well-qualified engineer or group of engineers, interested only in the constant improvement of the company's operations, appears to be the best type of personnel to handle suggestions. Personalities will then be prevented from entering the picture and the suggestor is assured of an unbiased and reliable criticism.

Should the reviewing engineers consider an idea to have merit, then is the time to call in the immediate superior for his comments. He will be more inclined to criticise accurately and less inclined to shelve the suggestion because of "too little

time," because it will be part of his job, and also because he knows that the idea has already received a sanction from the top side.

Management is chiefly interested in suggestions for profit; the suggestor for reward. Capable handling of suggestions encourages new ideas, promotes good will and increases profits.

Henry L. Abner
Flushing, L. I.

•

SINGLE TRACK OR DOUBLE TRACK MIND?

If tools are unnecessarily damaged when returned to the crib, this is an indication that immediate inspection is necessary when the tool is turned in, and the time to fix the responsibility is just then.

The practice of laying tools aside for future inspection is a prolific cause of useless arguments. The operator will claim he turned them in in good shape; or, worse, the damaged tools might be re-issued to an innocent party who is unaware of their condition until he starts to work with them. Invariably he will be blamed for their damage when he takes them back to the crib.

Ed, it seems to me, has developed an unnatural solicitude for Harry. Only a certain per cent of the tools given out and turned back at any crib really need close checking. That checking is part of the attendant's job. If he needs help in handling it, then he is right to call on Ed for suggestions. If he is just tired, then perhaps a job pushing a wheelbarrow for awhile might pep up his rundown energy.

W. F. Dolsen
Detroit, Mich.

•

When the crib attendant receives a tool and neglects to inspect it, his mind is probably mulling over a better system of storing material. If the man continues to receive damaged tools, he should be reprimanded, just as a machinist should be who turns out offsize work.

A machine operator presses buttons and turns handles all day long. As long as his mind is on something else, he goes through the motions automatically and produces at a normal rate. If he concentrated on his job, he would hesitate before each operation, or in some cases pull the wrong lever. His motions would not be rhythmic, consequently his output would be lower.

Many a toolmaker will go through

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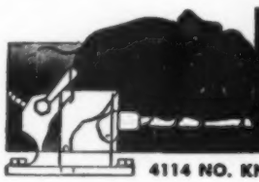

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the motions of drilling and tapping while his mind is planning the next operation or setup. A diemaker laying out a complicated die must have a one-track mind. The type of work a man is doing will determine whether he requires a one-track or double-track mind. The tool-crib attendant handling tools all day should be able to examine the tools without much effort, since the majority of the tools flowing through the crib can be inspected visually.

The type of man and the system to use for checking tools in and out of the crib is determined by the inventory value and the volume of traffic. A system that works well in one plant will not necessarily prove successful in another. The accounting department usually introduces a system which will facilitate the keeping of records for its benefit.

Frank J. Zarnowski
Rutherford, N. J.

•

As far as Ed's problem of identification of returned tools is concerned, a specific system can solve this complaint. When a tool is drawn from the crib, the borrower makes out a slip in triplicate. The original slip is given back to the employee upon return of the tool. The second slip is filed with the inventory card of the tool to indicate how many are in use and to whom they have been issued, so that the service activity of the tool can be determined and serve as a guide in stocking the tool in the future; and the third slip goes with the tool on loan and is returned to the crib as a means of quickly finding the proper bin location and also to identify the borrower.

Signature on the original form is binding and eliminates any cry of, "Someone stole one of my checks or I must have lost it." Equally, since responsibility can only be charged by the company to the borrower on the evidence of the original, the worker is protected.

The assigning of the one-track mind to the job considered "the easiest job in the shop" is a practice prevalent in the shop world, but can be avoided merely by the application of good management. Too often, tool-crib personnel are picked from the ranks of machinists too old or feeble to carry on their trade. It is definitely an error to assume that the job is one for the aged and no longer active machinist. His training is desirable, but not the prime requisite. Tool reconditioning in a crib of medium size is a full-time job and need no toolmaker's experience. Pride in the job should be evidenced by a desire to keep tools orderly and

free from dirt and rust. A good attendant can think up many jobs for his spare time that improve his lot and provide service for others.

Careful control of inventory alone can make this man worth a good deal to management, who should be willing to pay for this service. A tool crib represents an investment of many thousands, and poor control may cost the company additional thousands.

The tool crib is not the place for pensioners, who are only half there, nor is it the place for the young with no sense of responsibility, but should be staffed by men with energy and a strong sense of responsibility.

A. M. Elliott
Leroy, N. Y.

•

Ed has the right idea, that too many tools are returned to the tool crib in unnecessarily bad condition. It's surprising how many organizations either fail to notice this or neglect to do anything to prevent it. Both Ed and Al, however, are attempting to make a difficult job of a simple procedure.

Hundreds of plants where McCaskey Tool Control is used insure the inspection of tools returned to the crib in this way. Tools are issued on a duplicate slip made out by the employee. Two copies are retained in the crib and cross-filed visibly, one copy as a charge against the employee and the other to locate and account for the tool. The third copy is retained by the employee as long as the tool is in his possession. When the tool is returned, the employee returns the slip with it.

A receiving bench is provided behind the attendant in most cribs so the tool or tools, together with the slips, can be placed there until someone qualified to inspect them properly is available. This procedure worked in plants employing as few as 50 or 75 and as many as 35,000 during the war, and it is working today. Most of the crib attendants were girls who could not be expected to inspect the tools. Their supervisor, or someone competent for the job, was made responsible for it.

Ed overlooked one cause of damaged tools. Visit a tool crib and watch what happens just before shift changes. (You will see this in cribs where it is necessary for the attendant to go to the bin for a check, while the employee returning a tool waits for it): The pressure is on, and the crib attendant, 99 times out of 100, tosses the tool in the bin without inspection and totally disregards probable damage from the

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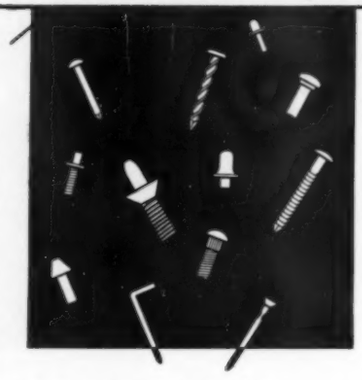

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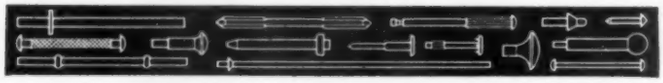

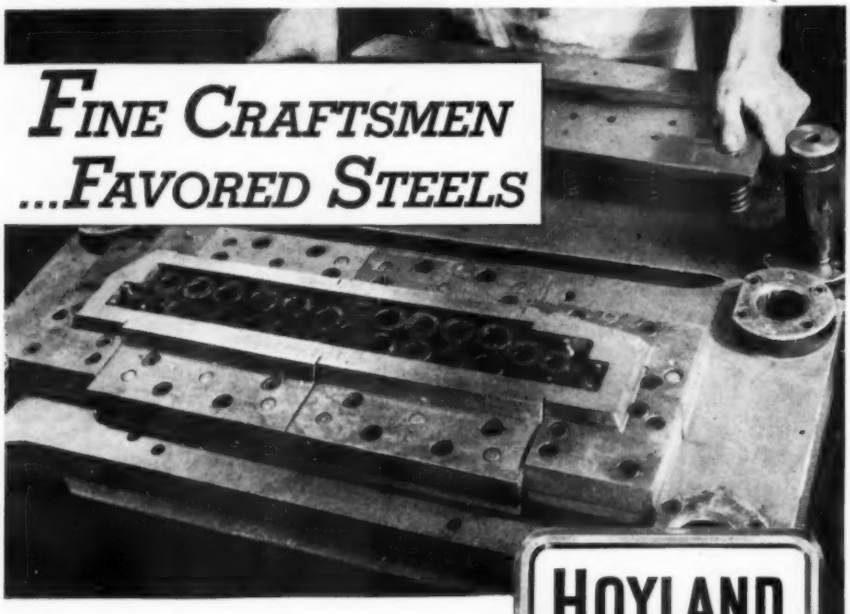

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An unusual assortment of fine tool steels . . . in various sizes, shapes, finishes, conditions . . . available promptly from the conveniently located warehouses of Hoyland Steel Company. Complete technical assistance in solving tool steel problems. Hoyland Steel Catalog-Work Book available on request.

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toss he is giving it. Naturally he is not going to take two trips to the bin if he can avoid it!

One large mid-western plant discovered that failure to inspect tools returned to the crib was permitting employees to trade "5-and-10 tools" for the more expensive ones supplied by the company. A veteran crib attendant in a Connecticut plant complained that the same condition was permitting toolmakers to trade carbon drills and similar antiquated tools for those issued by the company. In both instances the adoption of the system previously described stopped such replacements.

More could be said about the numerous savings that result from the use of duplicate or triplicate "Broken or Worn Tool Reports" whenever broken or worn tools are returned to the crib.

An aircraft company employing more than 10,000 recently has cut breakage more than 50% with a campaign based on the information secured through this procedure. An eastern manufacturer of air conditioning has not only cut breakage substantially, but has also compiled valuable tool preference lists for guidance in purchasing.

A mid-western manufacturing company of washing machines and other domestic equipment has used similar records both as a basis for reducing tool breakage and for information on tools and tooling that has been of great value.

Ed is on the track of substantial savings for his company, if he investigates the simple methods for doing the job that have been developed through experience in hundreds of plants during the last 20 years.

David Cameron
The McCaskey Register Co.
New York, N. Y.

•

DO MORALS AFFECT MORALE?

We all know that some romances begin in shops, culminating in marriage, and when such an event occurs, much pleasure is evidenced.

In Al's case, however, the situation is somewhat different. Although technically one of the boys, his executive authority compels him to adopt a somewhat aloof attitude toward his fellow workers. In the discharge of his duties, it may be necessary for Al as foreman to spend a little time at a female employee's bench, but this should not be regarded by Al as a social visit, and anything outside of conveying instructions or offering assistance should be strictly avoided.

Other workers resent the familiarity of an executive toward a female worker because they feel partiality will be shown her in case of errors, whereas her male co-workers would be subject to censure.

A foreman must ever keep in mind that his actions are watched closely by the workers, and any deviation from the straight and narrow will provoke comment.

Al should remember that, like Caesar's wife, he should be above reproach. Only thus will he keep morale at a high level and obtain willing cooperation from the other employees.

Milton E. Sussman
Brooklyn 20, N. Y.

•

Why should our dear old friend Al be deprived of his inalienable right to mingle with the opposite sex, if in so doing he does not compromise himself? There is no reason why he shouldn't be able to perform with executive effectiveness even though his heart flutters in ecstasy on occasion.

The question of Al stepping out on Mabel depends somewhat upon Mabel's status. If she happens to be a nagging life-termer, or if she spends most of her time running around with a crowd of brainless clucks, then more blonde-power to Al. If he has exercised wisdom and remained single, and he chooses to pick out a good multiplicand from the assembly line, that's his business. The old magnetic rule that unlike poles attract each other should not be ignored just because a man happens to be a foreman. Many a good wife has been obtained from a factory bench. But he should beware—it's the inner structure of the steel that withstands the shock of years.

John Homewood
Ontario, Calif.

•

A foreman, works manager, any executive, has absolutely no rights when it comes to mixing with women who work in the plant. The honorable type of man does not spread that type of jam on the bread and butter of his job.

Now, in this case, we don't know whether Al is married. He could be a single man, and thus a carefully controlled interest could be explained; but if he is married, he is just plain looking for trouble. "The road to Hell is paved with good intentions."

As an ex-works manager, it has been my province to have to observe and break up quite a few of these

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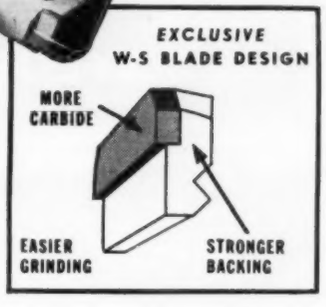
Design of Wendt-Sonis Adjustable Reamers assures outstanding performance of reaming operations. Cuts are smooth and true to close tolerances. Generous chip clearance allows maximum stock removal. Only selected materials, carefully heat-treated, are used in W-S Adjustable Reamers.



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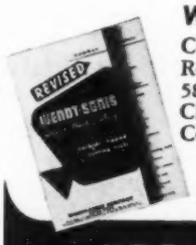


Write for W-S Catalog No. 646 Revised

Contains complete details and latest prices on W-S Adjustable Reamers. Write: WENDT-SONIS COMPANY, Hannibal, Missouri; 580 North Prairie Ave., Hawthorne, Calif.; 1361 West Lake St., Chicago, Illinois. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

WENDT SONIS

CARBIDE CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS
DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS
ROLLER TURNING TOOLS • SPECIAL BITS

ANY SPEED ... AT THE TURN OF A KNOB

PICK ANY SPEED WITHIN THE RANGE (250 to 1000, 360 to 1440, 545 to 2180, 875 to 3500 R.P.M.)

THE RIGHT SPEED ALWAYS COSTS LESS

TWO MODELS - 1 to 6 spindles
M-96 (shown) cap. ⅞
M-125 cap. 1⅜

THIS BULLETIN TELLS ABOUT THIS BETTER CONTROL

EST. TF 1834

THE TAYLOR & FENN CO.
HARTFORD 1, CONN.

117F48

WE TURN BLUEPRINTS into Action

Precision Gears Made to Your Exacting Specifications

When Sewall craftsmen go to work on your specifications, you are employing the extensive facilities of an experienced organization. Our engineers can give you valuable assistance in establishing the *one best design*—then in turning out uniform production runs. Illustrated are examples of a Sewall bevel gear and pinion . . . worm and worm gear . . . helical gear and pinion . . . Zerol bevel gear and pinion. *Send blueprints or samples for prompt estimates on any quantity.*

RACKS • SPROCKETS • SPUR • SPIRAL • BEVEL • ZEROL BEVEL • WORM GEARS

E. B. SEWALL MANUFACTURING CO.
688 Glendale St. St. Paul 4, Minnesota.

foreman-working girl intimacies. The supply of misunderstood husbands is everlasting, it seems.

I have never known any good to come of these alliances. The man often chooses to keep his interest under cover, but not the girl. She lords it over her companions, and expects—and gets—favors in matters of job allocation and other preferential matters. Immediately the other workers are on edge and the morale of the whole department suffers. Due to the complications of feminine dalliance, I have seen one president, several vice-presidents and numerous smaller fry receive their graduation papers.

I can remember several killings, many broken hearts, and a few broken homes that stemmed from these shop associations. Does an executive have privileges with the women who work for him? If he's smart, he doesn't.

James K. Matter
Detroit, Mich.

TO THE EDITOR

Your editorial in the July 15 AMERICAN MACHINIST entitled: "Unorthodox—But It Worked," was far more true to life than you know.

You should be in our business fully to realize that!

You have no idea how many men in high places, with college educations, have minds set in one mold of "What I do not know—or want to believe—absolutely cannot be."

Time after time, we have worked out a special tool, solving a special problem, even offering to put it in use on the basis of "No work—no pay" and got the "No, I can't see it."

In other words, men or so-called "executives" (????) close their minds to an idea just simply because they cannot see it.

We are in business today simply because I got mad at the asinine remark of a chief tool engineer of one of the biggest tool firms in the U.S. I tried to get them to market some tools. This party said: "It cannot work; I can't see it." When asked why, he said: "I have been here for over 25 years; don't you suppose that if the idea was any good and would work that I or our engineers would have thought of it?"

My idea was so "unworkable" that we sold several thousand during the war for jobs that available units were too big in every way to do.

Shades of the Pyramids! How in-

destructible—and permanent—must be the molds of some minds Or, should it be "The MOULD?"

NAME WITHHELD

"Quotes"

Special Department Aids Executive Control

ADDRESSING the 25th General Management Conference of the American Management Association, Gen. Brehon Somervell, president, Koppers Company, Inc., explained "the use of a special Control Section or Department as a major tool of the chief executive of any organization."

"In short, the Control Section is designed to control not what the company does but the way it does it. It acts as eyes and ears for the chief executive of the company or an operating division with respect to everything that has to do with the way in which the work of the company is performed.

"The work of the Control Section is divided into four main subdivisions: Planning and Policies, Organization, Reports and Statistics, and Procedures. It assists in guiding and coordinating performance throughout the company, in appraising results, and in correcting unsatisfactory conditions. It reviews with Staff Departments and Operating Divisions, the objectives and program of the company. It is continuously engaged in guiding and coordinating performance through bettering our organization, through the formulation of policies, through the development of inter-unit procedures, through progress reports, and through audits. It assists in correcting unsatisfactory conditions through careful analysis of problems, discussion of their phases with the units involved, and works with them in the development of remedies.

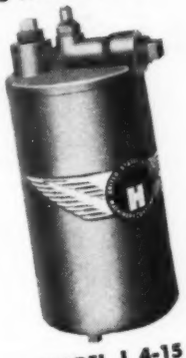
"Control Sections are also present in all of our operating divisions, which perform the same functions for the Vive Presidents and General Managers in charge of these divisions as does the central Control Section for top management. Control insofar as Staff Departments are concenrned, is furnished exclusively by the top-management Control Section. Units of the organization use the Control Section facilities for assistance in organization, planning, policy development, procedure design, program development, clearance of in-

EVEN WHERE SPACE IS LIMITED

HOFFMAN
Disc Filters

MODEL I 6-15 D
5 to 50 g.p.m.

Originally designed for aircraft, the Hoffman Disc Filter has been adopted and improved for industrial applications. Thus, you can get continuous flow of clean coolant, even in "cramped quarters". First cost is low . . . no moving parts to get out of order . . . minimum maintenance.

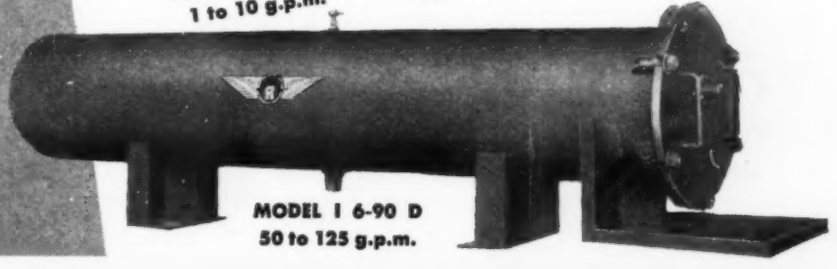


MODEL I 4-15 D
1 to 10 g.p.m.

Three sizes of this practical, efficient filter will remove dirt particles measuring from 3 to 5 micro inches. For further details and an estimate of the correct size for your requirements, write today.

NEW LOWER PRICES!

As more and more companies turn to Hoffman Disc Filters, increased production brings you new lower prices. Now in effect—ask us about them.



MODEL I 6-90 D
50 to 125 g.p.m.

U. S. HOFFMAN MACHINERY CORPORATION
211 Lamson St., Syracuse, N. Y.
COOLANT FILTERS • FILTRATION ENGINEERING SERVICE

"But you can't buy that kind of a motor..."

F—148

How many times have you heard somebody that ought to know better say something like that about motors, pumps, compressors or what-have-you? And how many times you heard somebody else say, "Oh yes you can! I saw just what we need in Blank Company's ad yesterday."

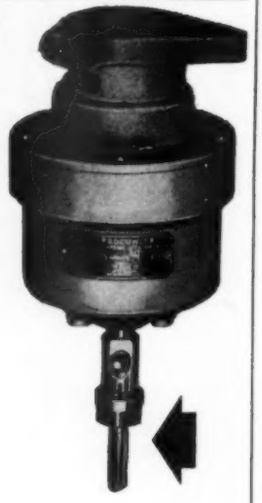
Advertising pages in this magazine are packed with *news* about your business. They contain information about products and services designed to help *you* do your job quicker, better and cheaper.

To be well-informed about the latest developments in *your* business, *your* industry . . . and to stay well-informed . . . *read all the ads too.*

HEADQUARTERS FOR INDUSTRIAL INFORMATION

American Machinist

"We've Found PROCUNIER Tapping Heads *PERFORM BEST!"**



That's what they all say . . . men who have used Procunier Tapping Heads in the shop for years. Consistent, accurate tapping and faster tapping with a minimum of tap breakage . . . *as reported by actual users* over the years . . . has made "Procunier" the standard of the industry. Such features as the sensitive, double-cone friction clutch, which engages the surfaces of the drive and reverse shells with a soft, "cushioned" action . . . the heat-treated gear reversing mechanism . . . the ball bearings for long life and accuracy . . . the simple, single-hole lubrication, have made Procunier noted for *economy, accuracy and better performance.* See how these Procunier Heads . . . proven on all kinds of jobs for over 30 years . . . can save you time and money. *Write today for brochure giving complete prices and specifications on the entire line.*

*Name on request.

Procunier
Safety Chuck Company
14-18 S. Clinton St. Chicago 6, Ill.

"Tru-Grip" Tap Holder

Lighter, smaller in diameter, it affords easier tapping close to walls or shoulders, eliminates "chewed up" tap shanks.

SEND FOR CIRCULAR

PROCUNIER SAFETY CHUCK CO.
14-18 S. Clinton St., Chicago 6, Ill.

Gentlemen:

Please send your illustrated brochures which give complete prices and specifications on Procunier High Speed Tapping Heads and Machines.

Name .....

Address .....

City ..... Zone ..... State .....

formation, preparation of special reports, mediation, coordination, training, and design of reports.

"Authority rests in the president of the orgganization insofar as the top-management Control Section is concerned, and in the General Managers insofar as the divisional Control Sections are concerned. If a control section ever sought to become a super central staff, its usefulness soon would disappear. Instead of being a welcome visitor in the divisions and other staff departments, it immediately would assume the guise of an inspector and critic, which would promptly minimize if not destroy its effect.

"As long as organization and controls are used to bring out the best in executives, to permit them to work most effectively as a team and yet not destroy their initiative, they are of maximum usefulness. Once they begin to serve as a damper on the spirits and enthusiasm of the personnel they become a liability rather than an asset."

•

Plastics Materials Supply

FRANK H. CARMAN, Plastics Materials Manufacturers' Assn., reported on current materials supply and probable future trends to the 1948 annual meeting of the Society of the Plastics Industry.

"My estimates of production and use of thermosetting molding powders are:

1945—149 million lbs.
1946—177 million lbs.
1947—236 million lbs.
1948—264 million lbs.

The 1948 rate is based on the first three months; this is already 12% above the 1947 actual production. The industry production rate is now about 180% of the 1945 rate."

Raw Material Supplies

The outlook with respect to those chemicals based on coal tars is not good. Industrial shutdowns affect supplies every time, even though well-filled pipe lines may make it possible to keep production running at relatively even rates.

"Current production of methanol is now running 12% above that of 1947, and the forecasts for this year have been for increases reaching as much as 35%. Formaldehyde is likewise in an improved supply status. Total production for 1947 was about 514 million lbs., and it has been stated that this could go to a thousand million lbs.

"Additional capacity for the manufacture of urea has been reported to the industry by two producers, and

it is anticipated that these expansions, together with imports, will permit molding-powder producers to continue to operate at capacity if required. Reports from several sources indicate that production of benzol is about in balance with requirements. There is little encouragement in the way of much additional phenol in the immediate future; a limited increase will be possible in the latter part of this year. It is not expected that thermosetting materials would be restricted by wood flour supplies.

Molding Powder Production

"Based on expansion of molding-powder capacity to come in and certain increases in phenol and urea, it is my guess that we can go about 17% over the present rate of production of phenolics by the latter part of 1948 and the production curve will then level off through 1949. With a continuing inflationary threat, there is little chance for lower costs in the immediate future.

"Production rates of thermosetting molding materials are now at new highs for the industry, and requirements are pretty well satisfied. In all probability, these levels can be maintained with some increases in 1948. Based on requirements at the present time, there is no prospect of shortages and there is every indication that we are now entering into a buyer's market for molding material."

NEW BOOKS

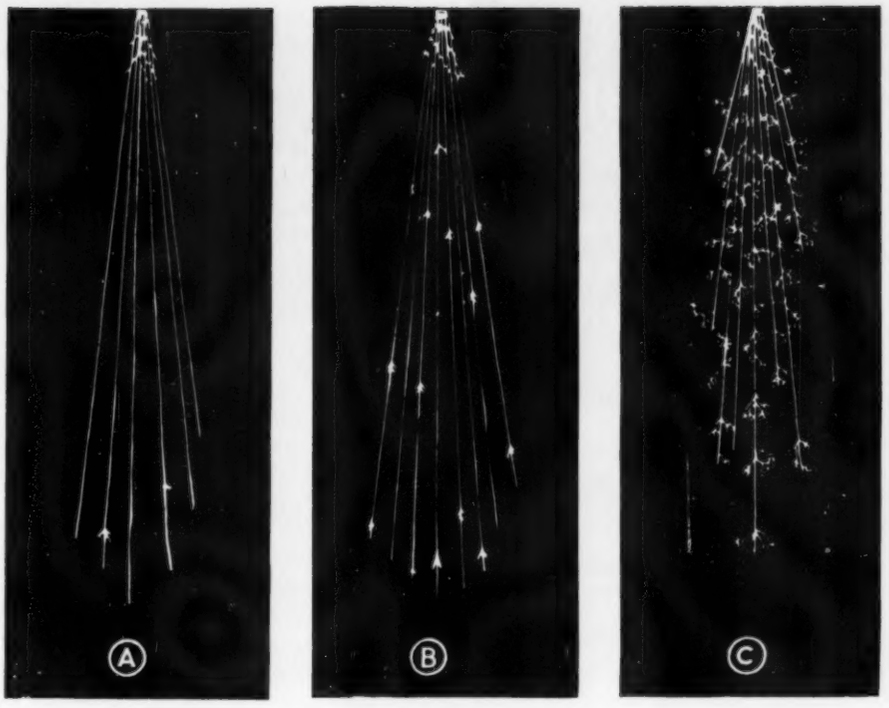
WHO, ME?—*By Arthur O. England. Published by The National Foreman's Institute, Inc., Deep River, Conn. 24 pages, 4⅝x6¾-in. Price, $.25*

This illustrated booklet shows how an executive can create better human relations among the individuals who work together in his group. Short, punchy text and many amusing cartoons present its worthwhile message in an interesting and easily understood manner.

•

QUALITY CONTROL—*By Norbert L. Enrick. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. 122 pages. Price, $3.*

In this book the author stresses the application of statistical plans to the control of quality in manufacture. He deals with 100 percent, sampling and process control methods of inspection, outlining the field and the



Mark your answers here. Carbon content of steel A. is ——% B. is ——% C. is ——% Correct spark readings are given at lower left

Can You Read These Sparks?

They Describe the Analyses of Three Steels

Steel bars of three different analyses gave off the sparks pictured above when touched by a revolving abrasive wheel. At Ryerson, we "read" these sparks to protect your production.

To the trained eyes of our experts, the spark pattern of a steel is as distinctive as a fingerprint. For example, the sparks shown here indicate straight carbon steels, with carbon content in the low, middle and high ranges. If chrome, nickel, molybdenum or other alloying elements were present, they would also be revealed in the spark pattern.

That's why spark testers patrol the bar sections of your nearby Ryerson plant. By checking all alloy and special quality carbon bar stock, they guard against mixed shipments. Help to assure the certified quality of Ryerson steels.

Spark testing is only one of many extra steps we take to make Ryerson a steel source you can call with confidence. Another—the special Ryerson Report sent with each alloy shipment. It charts the results of hardenability tests, shows how to heat treat for desired mechanical properties and includes other helpful data.

So play safe. Avoid the possibility of mixed steels by ordering from your nearest Ryerson plant.

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

PRINCIPAL PRODUCTS

BARS—carbon & alloy, hot rolled & cold fin., reinforcing
STRUCTURALS—I beams, H beams, channels, angles, etc.
PLATES—Sheared & U. M. Inland 4-Way Floor Plate
SHEETS—hot & cold rolled, many types & coatings
TUBING—Seamless & welded mechanical & boiler tubes
STAINLESS — Allegheny metal sheets, plates, tubes, etc.
MACHINERY & TOOLS

HERE ARE THE ANSWERS:

A — .10% B — .35% C — .95%

RYERSON STEEL

CROSS UNIVERSAL GEAR MACHINES

for

- ROUNDING
- CHAMFERING
- POINTING
- BURRING

Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

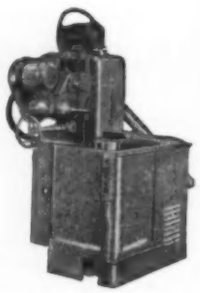
Special skill is not required because machines are automatic and push button controlled. Power clamping is foot pedal controlled. Both hands are free for work handling.

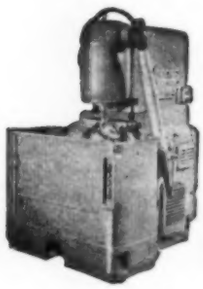
No. 55

For rounding, pointing, chamfering or burring external and internal:

spur gears
helical gears
clutches
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 net hourly.





No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 net hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
spiral bevel pinions
hypoid pinions

Typical productivity when chamfering 8 pitch 40 tooth gears is 200 net hourly.

THE CROSS COMPANY
Established 1898

SPECIAL MACHINE TOOLS
MILLING • DRILLING • TAPPING • BORING
TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN

procedure for each of these methods.

Tables for sampling are presented accompanied with instructions for their use. Sample charts for process control are explained and a method for constructing them is described. Included is an interesting chapter on elementary concepts in tolerances and allowances and one on gaging. The theory of sampling plans and control charts is treated briefly for those interested in the mathematical background.

This book is intended for the practical man who is primarily interested in basic statistical methods in inspection as a working tool and is less concerned with their mathematical derivation. As such, it accomplishes its purpose.

•

DIMENSIONAL ANALYSIS OF ENGINEERING DESIGNS. VOL. 1 COMPONENTS (PART I)—*Published by His Majesty's Stationery Office, London. Price $2.35.*

The difficulties of obtaining complete interchangeability of parts manufactured in different plants and inspected by different groups of inspectors, has led to the publication of this manual by an Inter-Services Committee established by the Ministry of Production. Its purpose is to furnish the product designer with a means of analyzing a design on sound, logical lines to insure that production and inspection are economical in relation to the known functioning requirements.

The basic principles required by draftsmen and designers for the determination of basic sizes, tolerances and allowances are stated and explained, and practical examples of their application are given. Part II of this volume is to be published later and will deal with gages.

•

MATERIALS HANDLING—*Published by the General Electric Company, Schenectady, N. Y. 92 pages. $1.00.*

This manual is a comprehensive survey of modern methods of handling materials in three phases of industrial operation: receiving, shipping and warehousing. Basic principles of material handling are explained and the application of many types of equipment is described. One entire section is devoted to a step by step procedure for making a material handling survey and another contains helpful engineering data on the selection and use of equipment. The manual should appeal to a wide audience.

Profit experiences-

WITH ELGIN Sapphire
WEAR RESISTANT

SAPPHIRE SHORTS P-113

SIZING TOOLS

Sapphire burnish-sizing tools are finishing powdered metal bearings without closing pores. Size is closer and finishes better. Sapphire does not seize or tear, imparts hi surface finish because its finish is less than 0.1 micro inch. Lasts longer, too. Time proved!

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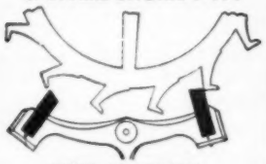
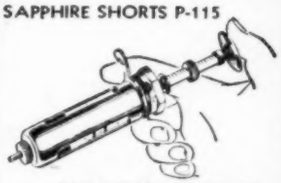


JEWEL BEARINGS

There is a reason for Sapphire jewel bearings. Illustrated is the escapement action of your watch where Sapphire rub-pushes steel 432,000 times per day, year in and year out under imperfect lubricating conditions. Inquire how to design Sapphire into your products for better life — better salability.

SAPPHIRE SHORTS P-115

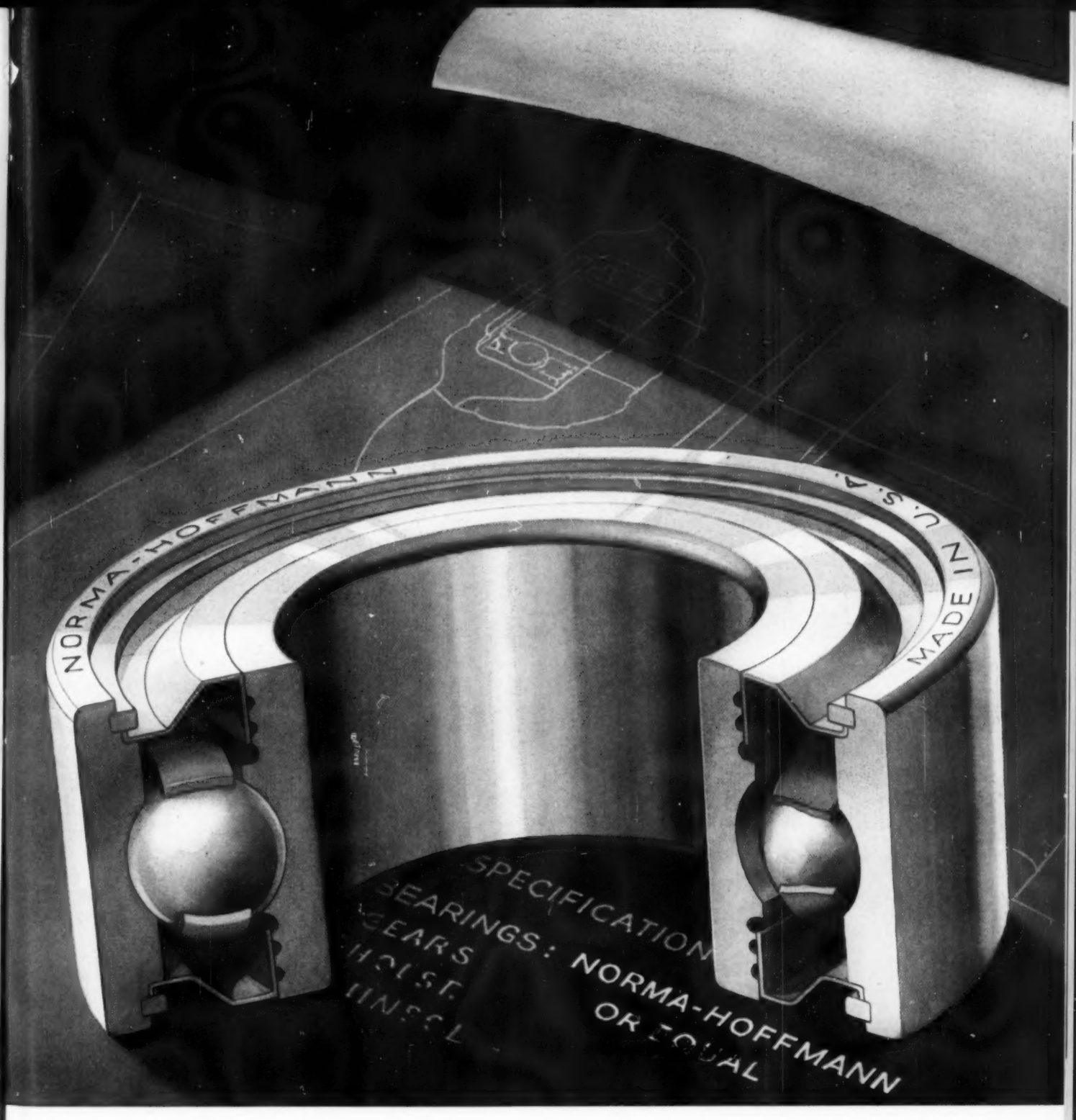


DIAMOND ABRASIVE

6 striking dies finished in time formerly taken for 1.
That is not exceptional, only explains, why Hyprez Diamond Compounds are cheaper to use. Finishes are also better — no contamination — foolproof — predictable results. Backed by 84 years of fine finish experience in production.

CHECK ITEM OF INTEREST — Tear out — write name on margin — mail in for descriptive literature.

ELGIN Sapphire
PRODUCTS DIVISION, AURORA, ILL.
ELGIN NATIONAL WATCH COMPANY



. . . There Is No Equal!

Leading manufacturers endorse the patented Norma-Hoffmann "Cartridge" Bearing because it is unequalled for continuous performance and long operating life.

The highly efficient seals plus the carefully metered volume of Norma-Hoffmann's specially compounded grease combine to give this bearing its unique operating characteristics. Designers of all types of equipment know from experience that there is no equal to its long-lived, efficient performance.

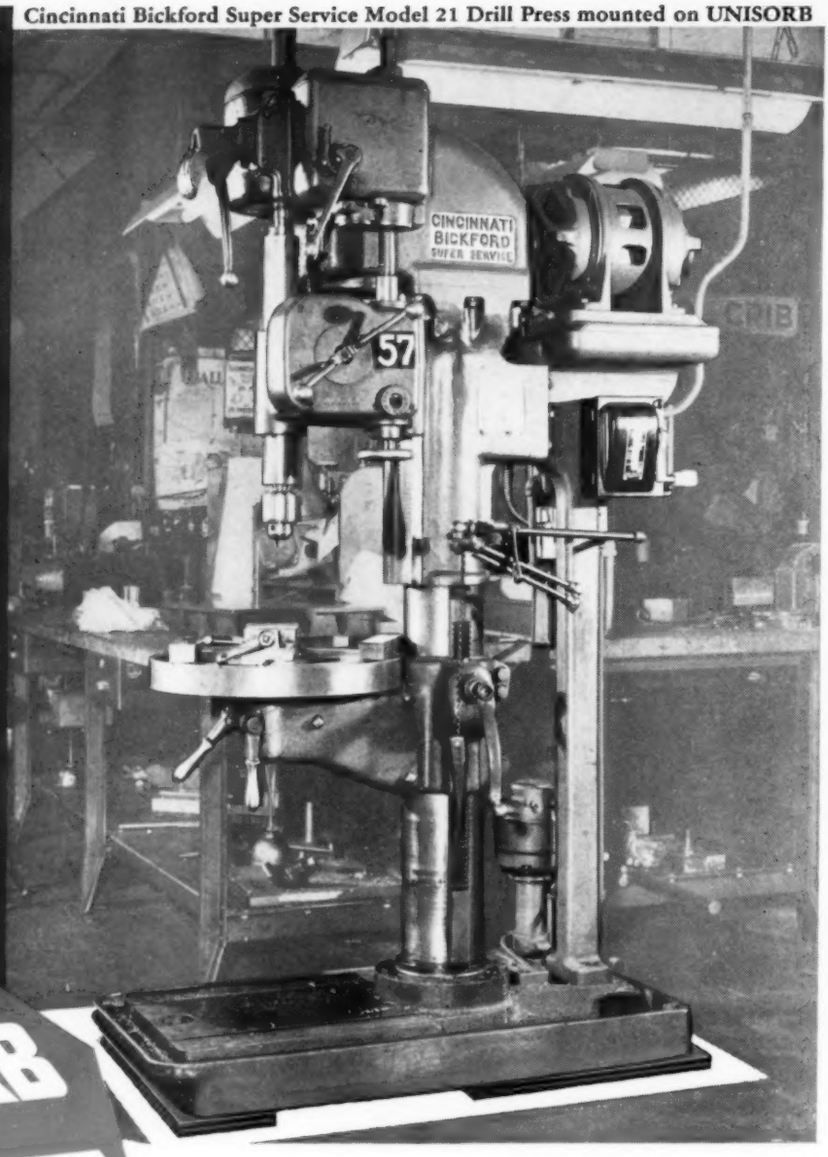
To give *your* customers greater value in *your* products, be sure your design prints read — "Norma-Hoffmann '*Cartridge*' Bearings."

NORMA-HOFFMANN
Precision
BEARINGS
BALL • ROLLER • THRUST

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONNECTICUT • FIELD OFFICES: New York, Chicago, Cleveland, Detroit, Pittsburgh, Cincinnati, Los Angeles, San Francisco, Dallas, Seattle, Phoenix

Cincinnati Bickford Super Service Model 21 Drill Press mounted on UNISORB

Reduce Vibration... End Needless Floor Damage



ANCHOR ALL MACHINERY ON UNISORB

NO BOLTS...NO LAG SCREWS...NO FLOOR DRILLING

UNISORB . . . *the modern way to mount machinery* . . . gives you 3 distinct advantages:

1. ENDS NEEDLESS FLOOR DESTRUCTION—As UNISORB requires no bolts or lag screws, there's no longer any need for destructive floor drilling to anchor machinery. Permanent set prevents riding.

2. SAVES INSTALLATION LABOR COSTS—Installation operations are reduced in number, simplified in method when you "Mount It On UNISORB."

3. REDUCES COSTLY VIBRATION DAMAGE—Because UNISORB absorbs from 60% to 85% of transmitted vibration and noise, it saves floors . . . saves buildings . . . *saves the machinery itself from harmful results of its own transmitted vibration!*

Today, write for a UNISORB sample and full details.

THE FELTERS COMPANY

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Offices: New York, Philadelphia, Chicago, Detroit
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MOUNT YOUR MACHINERY ON **UNISORB** ANCHORING PADS

Broaching CRANKSHAFT CHEEKS

at the rate of

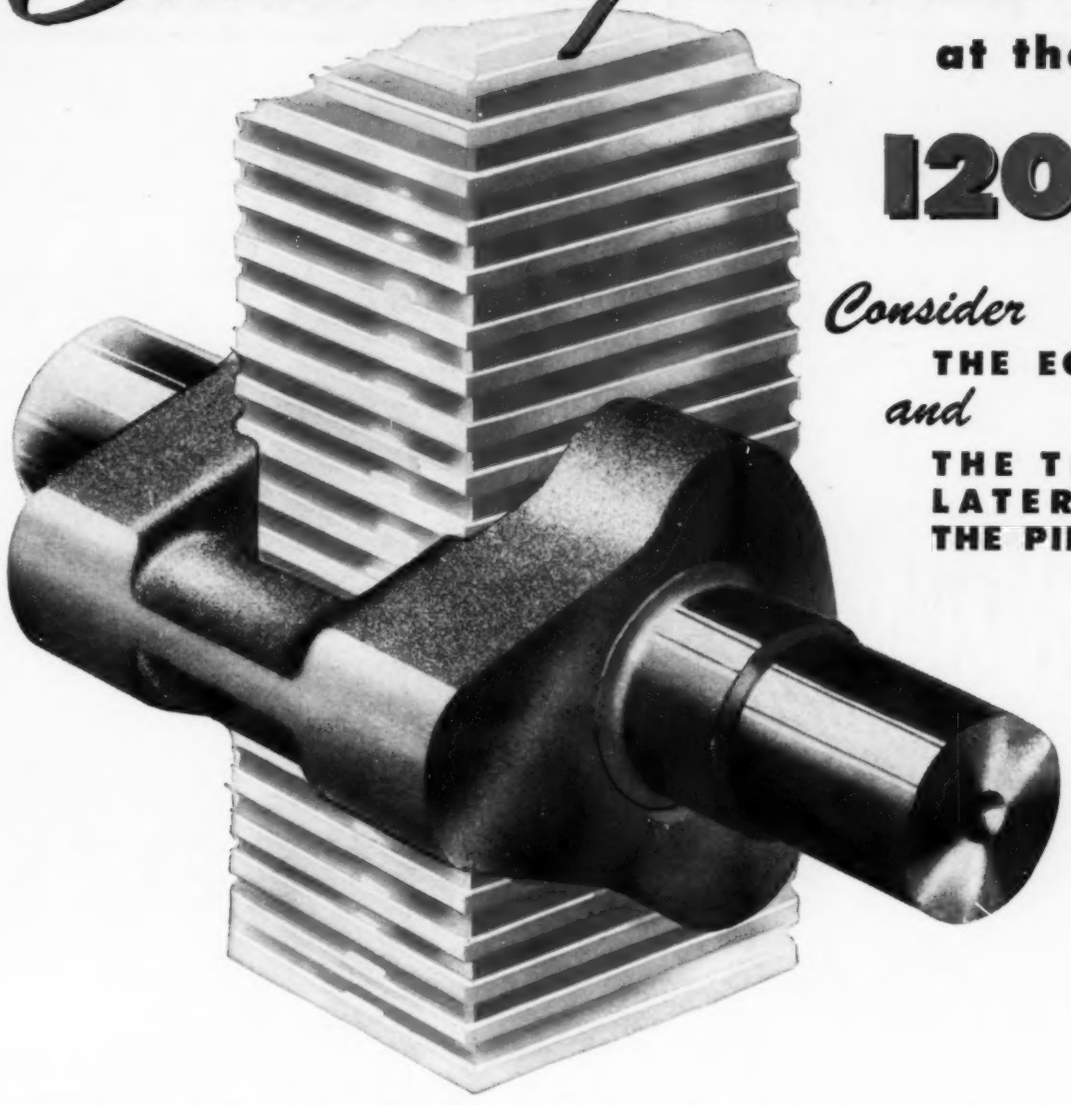
120 per hour

Consider

THE ECONOMY

and

THE TIME SAVED LATER TURNING THE PIN DIAMETERS



BROACHING the throw cheeks on crankshafts is an ideal broaching application. Tooling can be fairly simple and the production savings *really* worthwhile. Broaching removes the stock from the cheeks faster than any other method and thereby increases the production output when later turning the pin diameters.

This application shows one throw being broached, however, the tooling can be modified for multiple broaching, indexing, etc., to suit the application. This is but one of endless cost-cutting possibilities for broaching. New uses and applications for broaching are being developed all the time at Detroit Broach Company. Their experience and ingenuity are at your disposal to help you reduce manufacturing costs. Call your local representative or write today.

DETROIT *Broach* COMPANY
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THE CASE OF THE DOUBTFUL CONTRACT

Profitless grinding proposal becomes valuable business through use of

METALITE* BELTS

Even with his sharpest pencil this cutlery manufacturer could not figure any profit to him, using set-up wheels, in a proposed contract including rough and finish grinding sheath knives. Then he considered the belt backstand method — and the proposition immediately became good business.

Using a Hammond Model 3 backstand with Behr-Manning hard-density contact wheels, 12" x 4" x 1¼", and Durabonded Metalite Cloth Belts, grit #60-X and #100-X, he realized the following production performance: First, production volume 60% above "profit-level" estimate; second, production costs 45% below "profit-level" estimate.

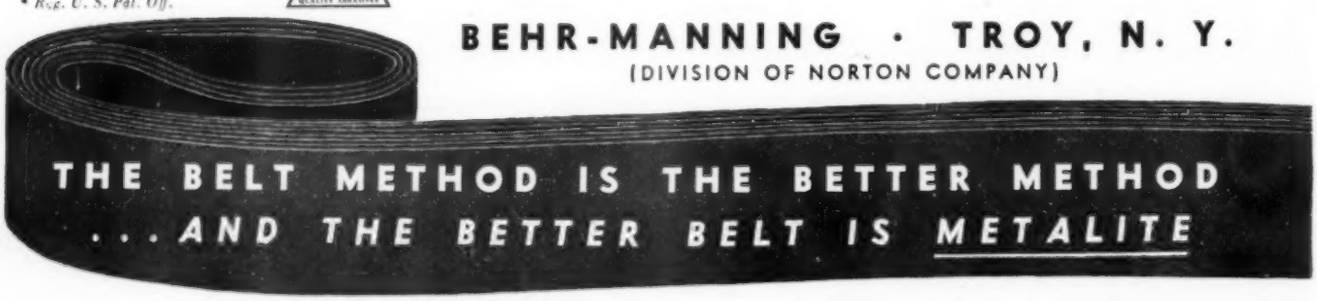
In any off-hand grinding job, it pays to check on the advantages of the belt-backstand method with Metalite belts. You can do this right in your own plant with our free demonstration service. No obligation — simply write, phone or wire us.

GET THE COMPLETE SERIES

Our booklet "Production Talks — Backstands" gives you a whole series of similar case histories with convincing facts and figures. Write for your copy today.

* *Reg. U. S. Pat. Off.*

BEHR-MANNING · TROY, N. Y.
(DIVISION OF NORTON COMPANY)



First quality high speed steels

RIGHT . . . right from the start! The fine, sound tool steel our customers depend upon from Vanadium-Alloys is quality-determined *before* each heat by our exclusive Controlled Melting Formulas. With forty-five years of experience in producing First Quality tool steels, we formulate precise blends of materials for each furnace charge according to our special knowledge. This is a *basic* step in achieving the easy-working, tough-hardening character of our steels, so well-known throughout industry.

• *Can we serve your requirements?*

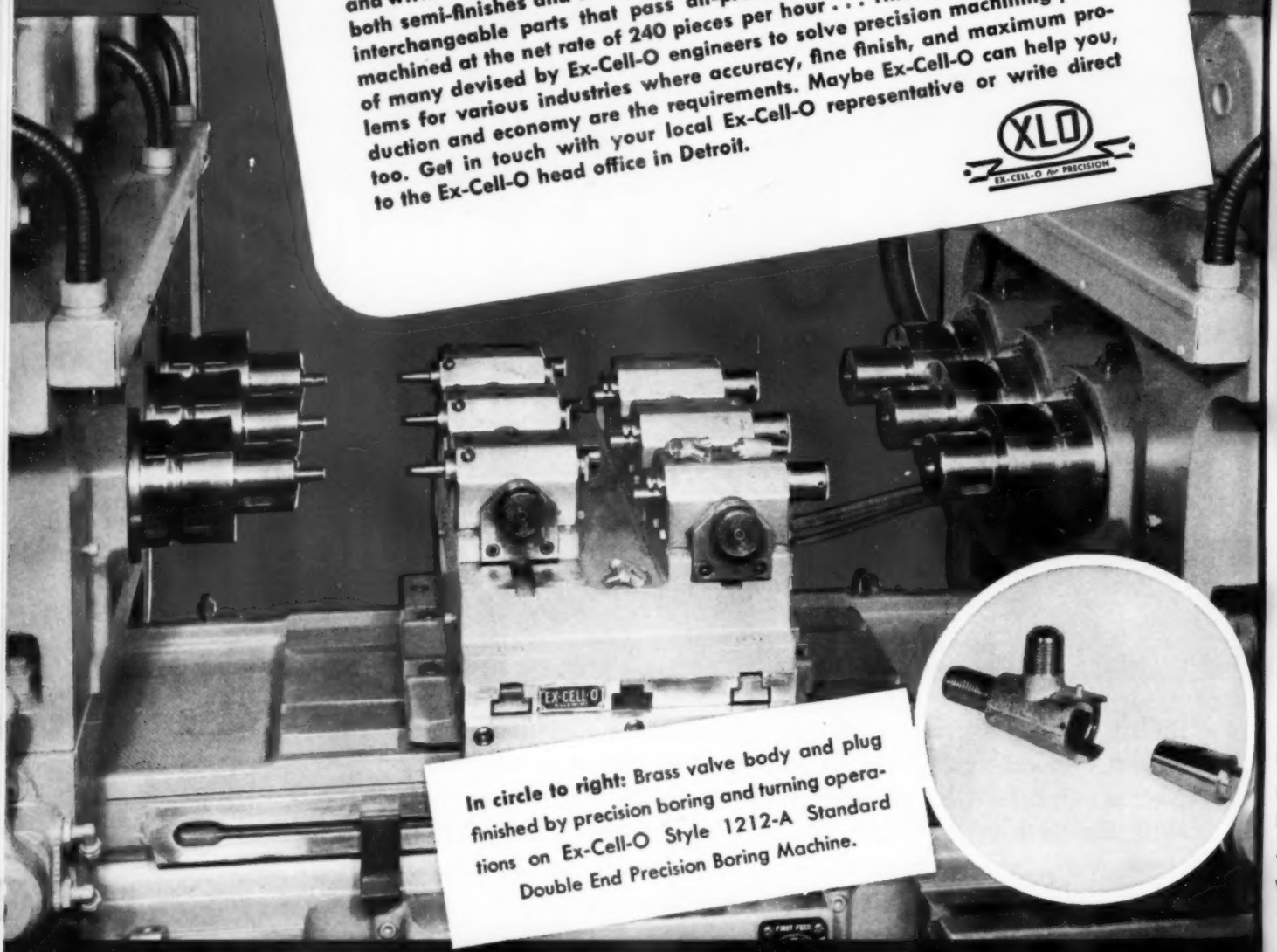
Vanadium-Alloys
STEEL COMPANY
COLONIAL STEEL DIVISION ANCHOR DRAWN STEEL CO.
LATROBE, PENNA.

Manufacturers of
FIRST QUALITY
TOOL and DIE STEELS
—exclusively

EX-CELL-O CAN GIVE YOU MORE ECONOMICAL PRODUCTION

. . . for instance: This view of the tooling on an Ex-Cell-O Precision Boring Machine shows an arrangement for precision taper turning valve plugs (*at left*) and for precision taper boring the mating bodies (*at right*). Plugs and bores must be perfectly round and straight, with tapers matched exactly, and with a mirror-like finish to assure air-tight valves. This Ex-Cell-O machine both semi-finishes and finishes both pieces in one machine cycle, producing interchangeable parts that pass air-pressure tests under water. Parts are machined at the net rate of 240 pieces per hour . . . This operation is typical of many devised by Ex-Cell-O engineers to solve precision machining problems for various industries where accuracy, fine finish, and maximum production and economy are the requirements. Maybe Ex-Cell-O can help you, too. Get in touch with your local Ex-Cell-O representative or write direct to the Ex-Cell-O head office in Detroit.

XLO
EX-CELL-O for PRECISION



In circle to right: Brass valve body and plug finished by precision boring and turning operations on Ex-Cell-O Style 1212-A Standard Double End Precision Boring Machine.

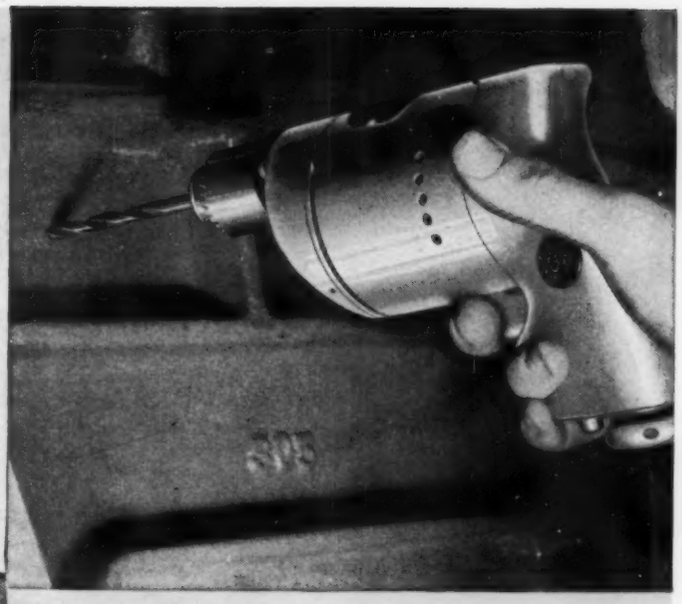
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles • Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

For Drilling in Close Quarters . . .

A streamlined Black & Decker ¼" HOLGUN makes it a lot easier to drill holes in hard-to-reach places—where even your hand seems cramped! With its amazing compactness, this handy Drill gets you in and out of the tightest spots. It measures only 6¾" overall, with short working clearance and spindle offset of only ¾".



For Continuous Production Drilling . . .

Take a B&D-built motor with abundant power for continuous drilling. Add splined gear mountings and special ball spindle bearing for severe operating conditions. Give a choice of any one of seven spindle speeds—from high torque at 500 R.P.M to high speed at 5,000 R.P.M. There you have the Black & Decker HOLGUN—a production Drill that has everything for saving time and cutting costs!

BLACK & DECKER
¼" HOLGUN
$35.00

You Can't Beat SPEEDY Black & Decker HOLGUNS*

Whether you're handling repair jobs or keeping a production line humming, take a good look at what the Black & Decker ¼" HOLGUN has to offer! Power, stamina, compactness . . . this "Handful of Power" combines all three for every kind of drilling job . . . in metal sheets, castings, forgings, wood, plastics and other materials. And at the low price of $35.00, you get plenty of Drill for your money!

Ask your nearby Black & Decker Distributor for complete details. Write for free catalog, describing over 100 work-saving Black & Decker Portable Electric Tools, to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Maryland.

*Trade Mark Reg. U. S. Pat. Off.

HERE'S THE "INSIDE STORY" ON BLACK & DECKER QUALITY!

1. Deep-groove ball bearing on chuck spindle, with inner and outer races each locked in place, minimizes wear, insures greater spindle accuracy and eliminates nose-heaviness.

2. Splined mounting of spindle gear increases strength, facilitates inspection, reduces noise, friction and wear.

3. Needle roller bearing on back end of spindle.

4. Full-power Black & Decker-built universal motor.

5. Famous "Pistol Grip and Trigger Switch" fits naturally into any hand, right or left.

6. Full-size armature pinion, with 12 teeth, insures smooth, noiseless operation, less wear and longer service.

. . . PLUS Many Other Quality Features!

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker
PORTABLE ELECTRIC TOOLS

This forging started right and will end right...

BECAUSE IT'S MADE WITH BASIC *Electric Steel*

● While the quality of the steel used is only one of many factors in producing exceptional steel forgings, it should be the first factor to consider in selecting your forging maker.

If your forging has a tough job to do, if it must stand up and give dependable performance over a long service life, if it must be capable of withstanding shock loads with high impact resistance, the character of the steel should be your primary consideration.

National Forge makes its own forging steel by the basic electric process—the process admitted to be superior for quality steel making. With the resultant finer grain structure and freedom from impurities, segregations and porosity, you can count on forgings with inherently greater strength.

Why not let us give you the technical reasons for specifying electric steel in your forgings . . . and also explain how the forgesmithing, heat treating and high precision finish machining are handled at National Forge. You'll buy better forgings if you let us place these facts in your hands.

NF

National Forge

AND ORDNANCE COMPANY

Irvine, Warren County, Pennsylvania

STEEL MAKERS ☆ FORGESMITHS

HEAT TREATERS ☆ MACHINISTS

NEW Oakite lubricant for ball burnishing gives you these 4 important advantages . . .

Cushion-like lubrication which prevents scratching metal-to-metal contact.

Rich suds in hard or soft water at economically low concentrations.

Free-rinsing action that suspends dirt in solution; prevents soapy film build-up on balls and work.

Resistance to acids carried over from rinse after bright dip.

. . . at low cost!

WHEN you smooth out minute irregularities on your metals by ball burnishing, you need a durable lubricant that protects surfaces. Oakite Composition No. 3 provides that lubrication.

Oakite Composition No. 3 not only lubricates but gives required suds even in hard water areas. It is free of ingredients that might attack metal. Oakite Composition No. 3 also suspends dirt . . . keeps it from smudging the luster of burnished work. It leaves no unrinsable soapy film on work or balls. Helps you bring out clean luster on your metal surfaces—safely.

Use Oakite Composition No. 3 for better, safe burnishing of steel, brass and aluminum parts. Use it to clean and condition balls and shapes. Use it as a medium for storage of balls and shapes.

Free Service Report gives full details on the use of Oakite Composition No. 3 for ball burnishing. Also shows methods for cleaning steel, brass and aluminum *before* burnishing. Just send request on your letterhead.

Practical Advisory Service: Your Oakite Technical Service Representative will gladly help you set up pre-cleaning procedures and work out proper concentrations for burnishing solutions. Check with him for data on all your cleaning and surface preparation jobs. No obligation.

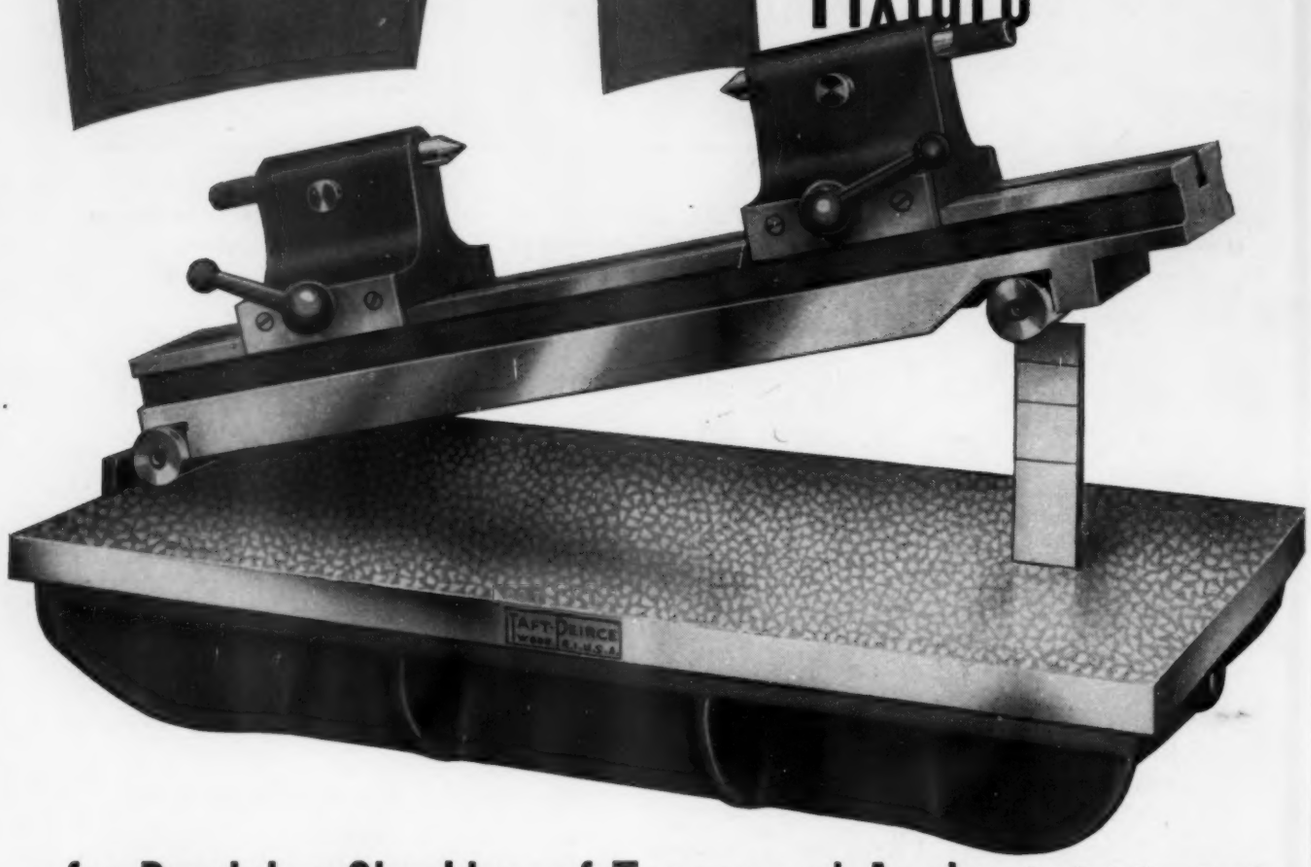
OAKITE PRODUCTS, INC.
24 Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE

MATERIALS
METHODS
SERVICE

Specialized Industrial Cleaning

2 in 1 Taft-Peirce Sine Block Taper Testing Fixture



...for Precision Checking of Tapers and Angles

Taper Testing Fixture mounted on Taft-Peirce Precision Surface Plate Style 9211

Here's a versatile Taft-Peirce fixture which will do a double job in any toolroom. First it enables you to check tapers up to 15" long and 6" in diameter with an unusually high degree of accuracy. Also, when center heads are removed, it gives you an extra-long (20") sine bar for extremely precise angle checking.

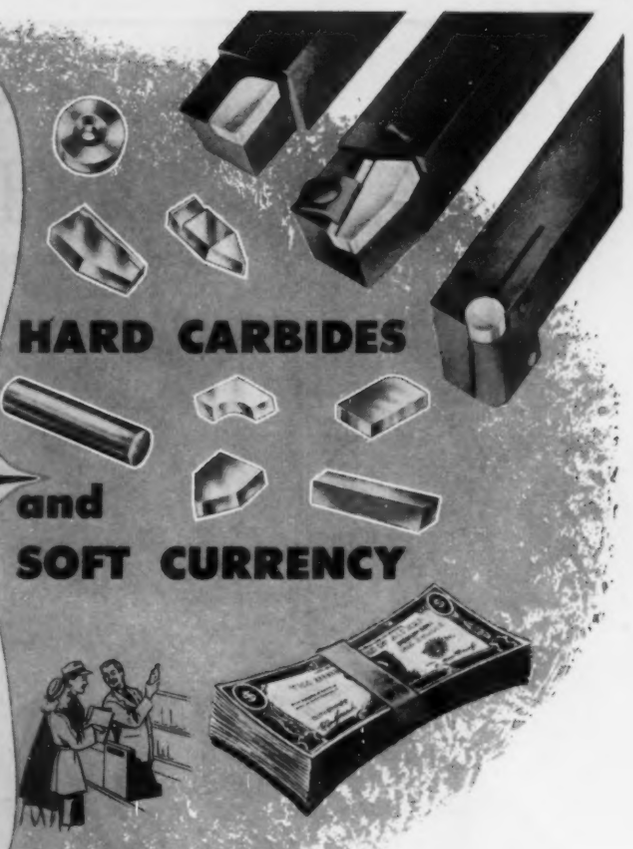
Made to top-precision standards, this sine block fixture insures top-precision in inspection. The sine block is made of an alloy steel, hardened, treated to insure stability, and precision ground. The sine plugs are identical in diameter and are accurately spaced twenty inches from center to center; the centers are lapped to a close fit and are in perfect alignment.

For additional information about this unusual Taft-Peirce fixture, and the many other top-precision Taft-Peirce Toolroom Specialties write today for the Taft-Peirce Handbook.

THE TAFT-PEIRCE MFG. CO., WOONSOCKET, RHODE ISLAND

T-P *means* TOP PRECISION

TOOLS of INDUSTRY and TRADE



MONEY, certified as to weight and fineness by our Federal Government, and Kennametal Tools, made by Kennametal Inc.—a private concern at Latrobe, Pa.—are both tools of present and potential value to a free America.

How is sound money a necessary tool for free people? It facilitates honest exchange of goods and services between persons. Thus it is used as a measuring tool. How well it serves its purpose depends upon the degree of certainty which persons may place upon its present and future value.

Kennametal Tool Blanks and Kennametal Tools merit confidence as to their value. They facilitate daily production in metal-working shops, in mines, and in construction work, enabling the workers to do their work effectively, thus helping maintain high standards of living in times of peace and providing weapons for our defense in times of war. Durability, hardness, and utility are embodied in Kennametal products.

Money will serve its necessary purposes, inspiring thrift, lending for worth-while enterprise, and protecting the real value of savings accounts, life insurance, and customary forms of saving, only when uncertainty is removed by stabilizing our currency, as proposed in a bill now pending before Congress*. A deteriorating, non-redeemable money robs all who earn and save.

There is no uncertainty about Kennametal. It is not a mere fiat certificate of value; it has intrinsic worth—lasting merit—as valuable 10 years hence as now—one piece equally as good as another.

This uniformly excellent tool material is obtainable "on demand" at our plant at Latrobe, Pa., or any of our branches in industrial centers of the United States. It is truly the "All American Carbide". From our new Catalog 48 you can order the tool tips and complete tools you need, with assurance that full value will always be realized.

Gold is the Tool that Shapes World Security

"I wonder what the Vintners buy
One half so precious as the Goods they sell."
Rubaiyat of Omar Khayyam

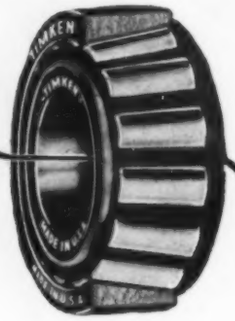
* **BILL H. R. 5031** introduced into the House of Representatives, January 20, 1948, by Congressman Buffet of Nebraska cited as the "Gold Standard Act of 1948."

A BILL

"To restore the right of American citizens to freely own gold and gold coins; to return control over the public purse to the people; to restrain further deterioration of our currency; to enable holders of paper money to redeem it in gold coin on demand; to establish and maintain a domestic gold coin standard; and for other purposes."

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc., LATROBE, PA.

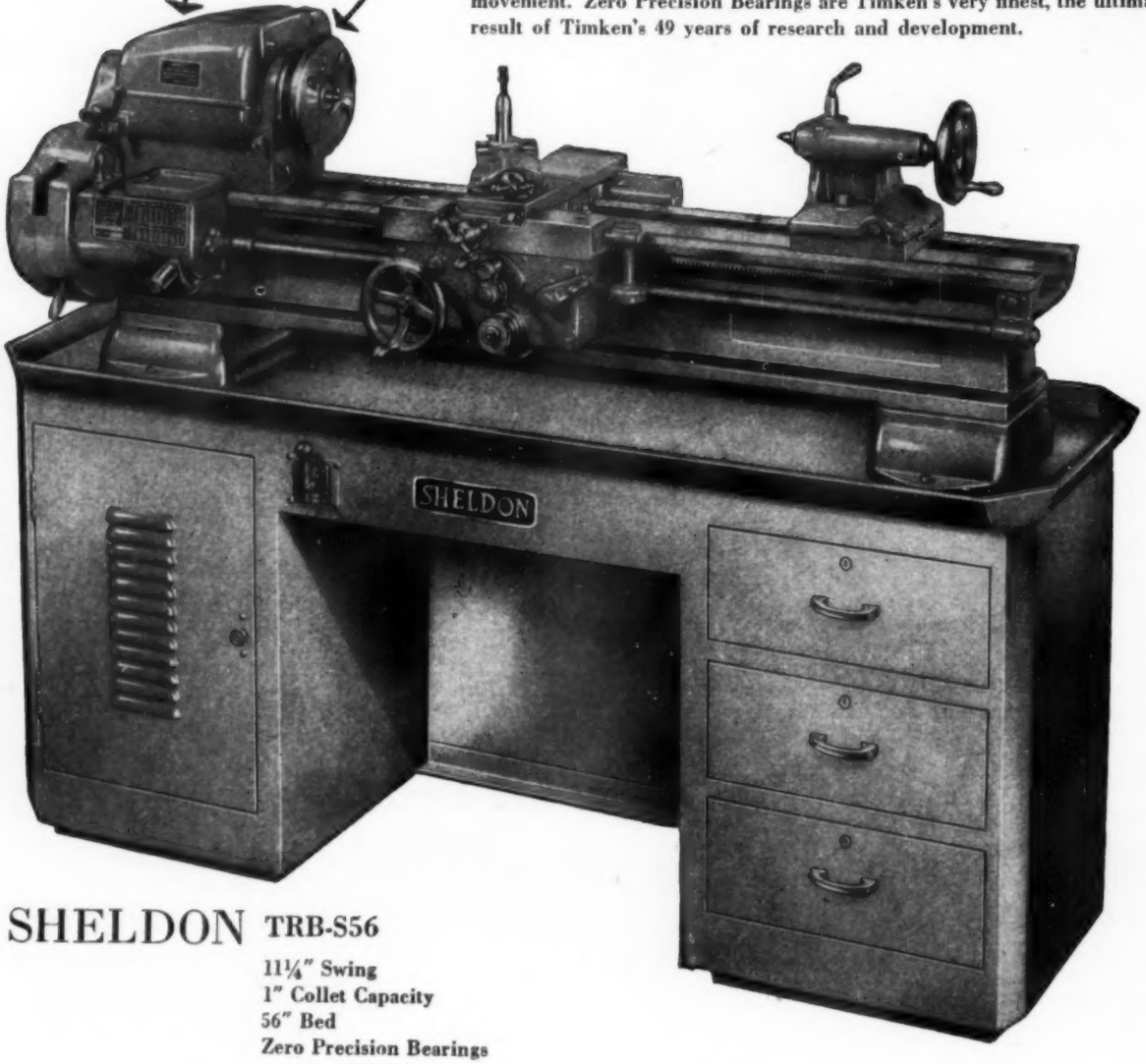
TIMKEN *Zero precision bearings* *give* SHELDON *LATHES GREATER ACCURACY*



Because the spindle of the SHELDON TRB-S 56 is mounted on Timken Zero Precision Bearings extreme accuracy, higher machining speeds and lower production costs are insured.

Timken Zero Precision Bearings are by far the most accurate tapered roller bearing that can be made in regular commercial production. Run-out or eccentricity is restricted to less than .000015 of an inch. Cups and cones of Timken Zero Precision Bearings are matched and shipped as a complete unit.

Due to the line contract between the rolls and races, the spindle is firmly supported—no chance of deflection. Because of the tapered construction and provision for take-up in assembly, there is no possibility of end-movement. Zero Precision Bearings are Timken's very finest, the ultimate result of Timken's 49 years of research and development.



SHELDON TRB-S56

11¼" Swing
1" Collet Capacity
56" Bed
Zero Precision Bearings

SHELDON MACHINE CO. Inc.

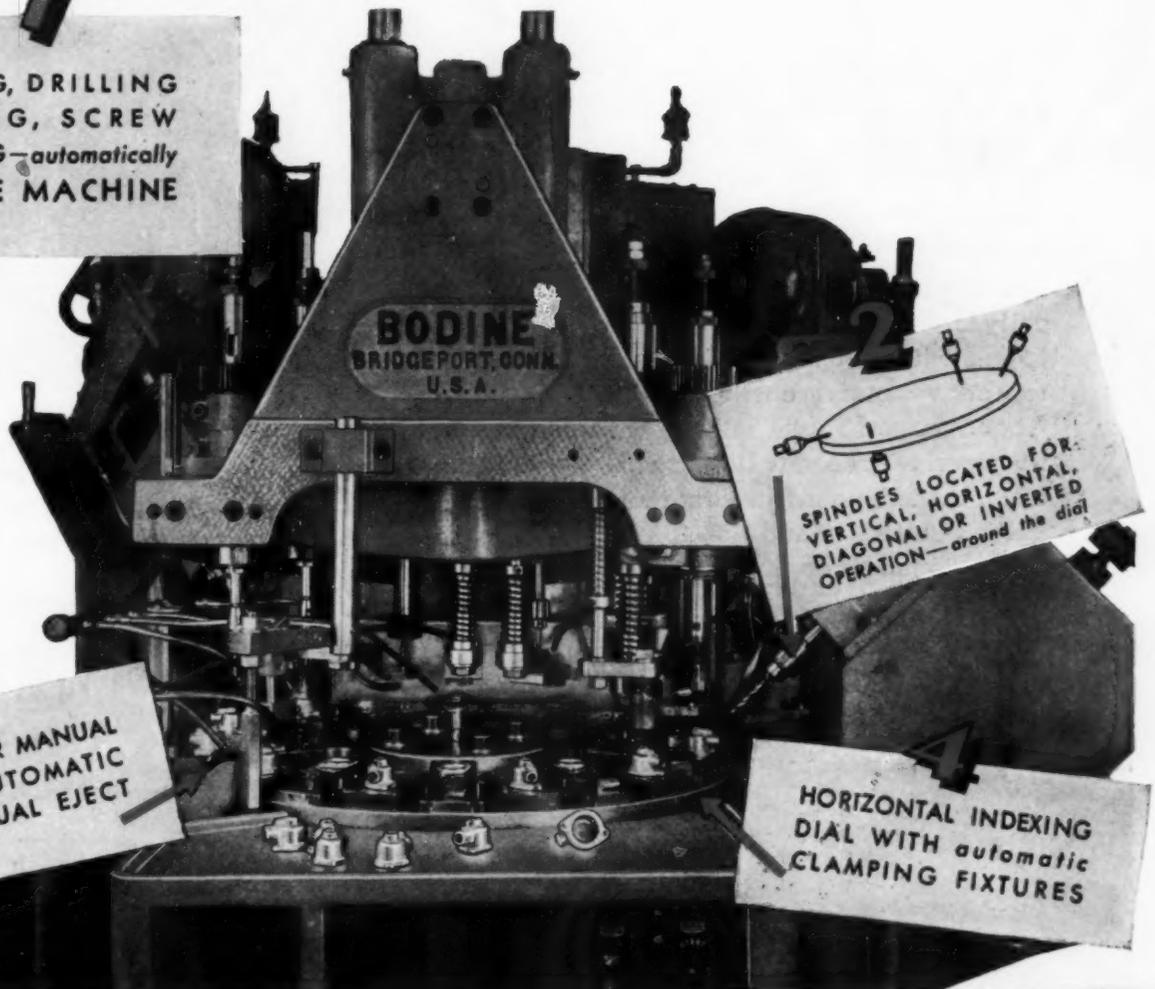
Manufacturers of Sheldon Precision Lathes • Milling Machines • Shapers
4234 N. KNOX AVENUE CHICAGO 41, ILLINOIS, U.S.A.

"Wanta make something out of it ?"...

...Get a Bodine

YOU CAN HAVE

1 MILLING, DRILLING TAPPING, SCREW INSERTING—*automatically* IN ONE MACHINE



2 SPINDLES LOCATED FOR: VERTICAL, HORIZONTAL, DIAGONAL OR INVERTED OPERATION—*around the dial*

3 HOPPER OR MANUAL FEED—AUTOMATIC OR MANUAL EJECT

4 HORIZONTAL INDEXING DIAL WITH *automatic* CLAMPING FIXTURES

If you require repetitive production of small parts check with BODINE ENGINEERS. Six sizes, tooled to your specific job... for high speed, low cost processing.

"You can't meet tomorrow's competition with yesterday's machine tools."

SEND FOR BULLETIN AM

THE **Bodine** CORPORATION

BRIDGEPORT 3 CONNECTICUT

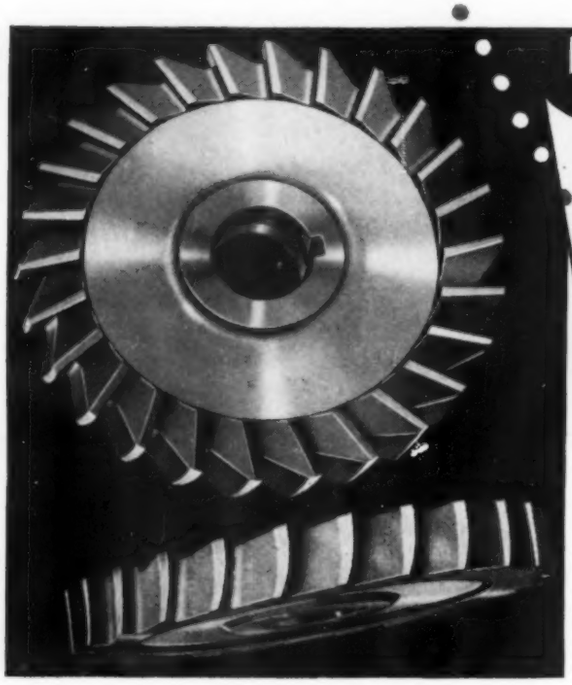
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING AND SCREW INSERTING MACHINES

78D48

150 to 425

YES . . . in a recent comparative performance test, 150 Aber "Curved Tooth" milling cutters *out-performed* 425 conventional type milling cutters — a 2½ to 1 increase at NO EXTRA COST!

Designed and developed specifically for production men who look to NEW tool designs to reduce top-heavy metal cutting costs, Aber "Curved Tooth" milling cutters operate at speeds 10% to 25% faster than standard straight tooth milling cutters in addition to providing smoother finishes and close to tolerance operations. Utilizing the most outstanding tooth design developed in the past decade, Aber Engineering Company produces a complete line of quality milling cutters featuring the "Curved Tooth" principle.



A TYPICAL ABER "CURVED TOOTH" PERFORMANCE

OPERATION: Milling lugs on plate. Slotting and side milling parallel sides.

MACHINE: Cincinatti 3-Spindle Mill.

TOOL SETUP: (1) R. H. and L. H. Shear Side Milling Cutter.
(1) R. H. Half Side Milling Cutter.
(1) L. H. Half Side Milling Cutter.
Feed: 10-1 2"

PERFORMANCE: 16-1 2 hours between grinds. Best previous practice with conventional, straight tooth H. S. S. milling cutters was 6-1 2 hours between grinds.

KEEP UP TO DATE with tool design progress. Write today for more detailed information on the ABER line of "Curved Tooth" milling cutters.

ABER
ENGINEERING WORKS INC.
WATERFORD 2, WISCONSIN

Saves $1,200 a year on "Crack-the-Whip" Drive

"Cracking the Whip" is fun for the riders of a Pennsylvania Amusement Park, but it's one of the toughest drive applications. The fast starts, rapid accelerations and sudden stops cause ordinary belts to slip . . . burn and wear through.

Take the case of this Park Owner. During the 1946 park season, his "Whip" wore out 3 of the 40-foot, original-type belts. He had to replace them at a cost of $400 each.

Then he called the Dayton V-Belt Distributor. His problem was studied. The power, speed and space limitation analyzed. Recommendation: Use the old wood—flat driven pulley, install standard Dayton V-Belts and Dayton Motor V-Pulleys. Nothing "special" required. Result: After two years, no slippage, no burning, no wear through. $1,200 a year saved.

When it comes to transmitting power, Daytons can do it better and save you money. Your local Dayton V-Belt Distributor has specialized knowledge and complete stocks.

For a better, more profitable solution to your drive problem, call your local Dayton V-Belt Distributor.

THE DAYTON RUBBER COMPANY
Main Office and Factory: Dayton 1, Ohio
Branch Offices: Atlanta, Boston, Chicago, Cleveland, Dallas, Detroit, Los Angeles, Minneapolis, New York, Philadelphia, St. Louis

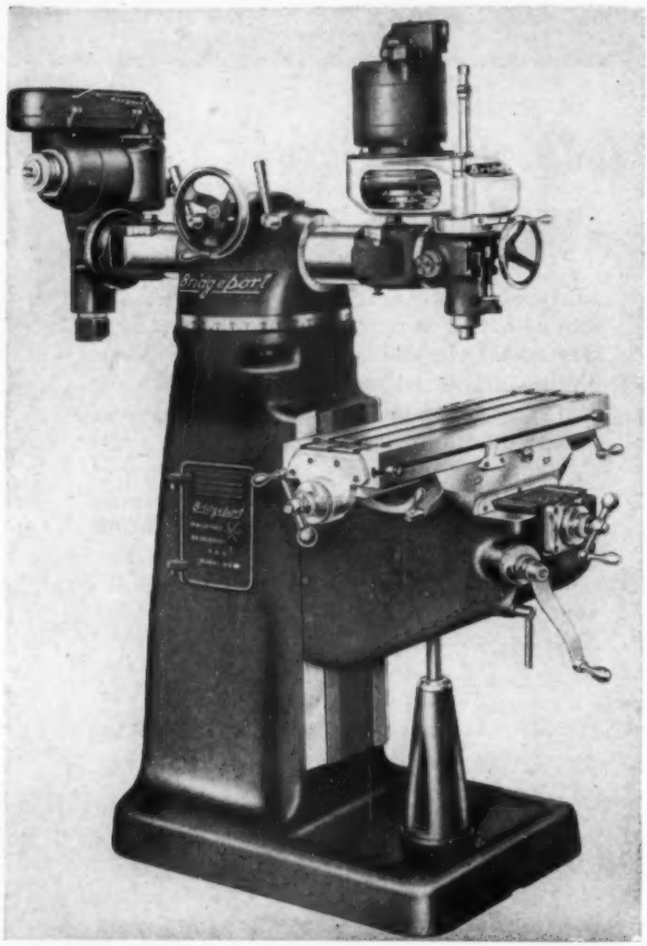
V-Belt Buyers! A leading mill supply house near you offers specialized Dayton V-Belt service. Look for the name under the trade name heading "Dayton V-Belts" in the yellow pages of your telephone directory.

Dayton Rubber

Bridgeport

TURRET MILLING MACHINE

ONE *Machine does the work of several with* ONE *set up*



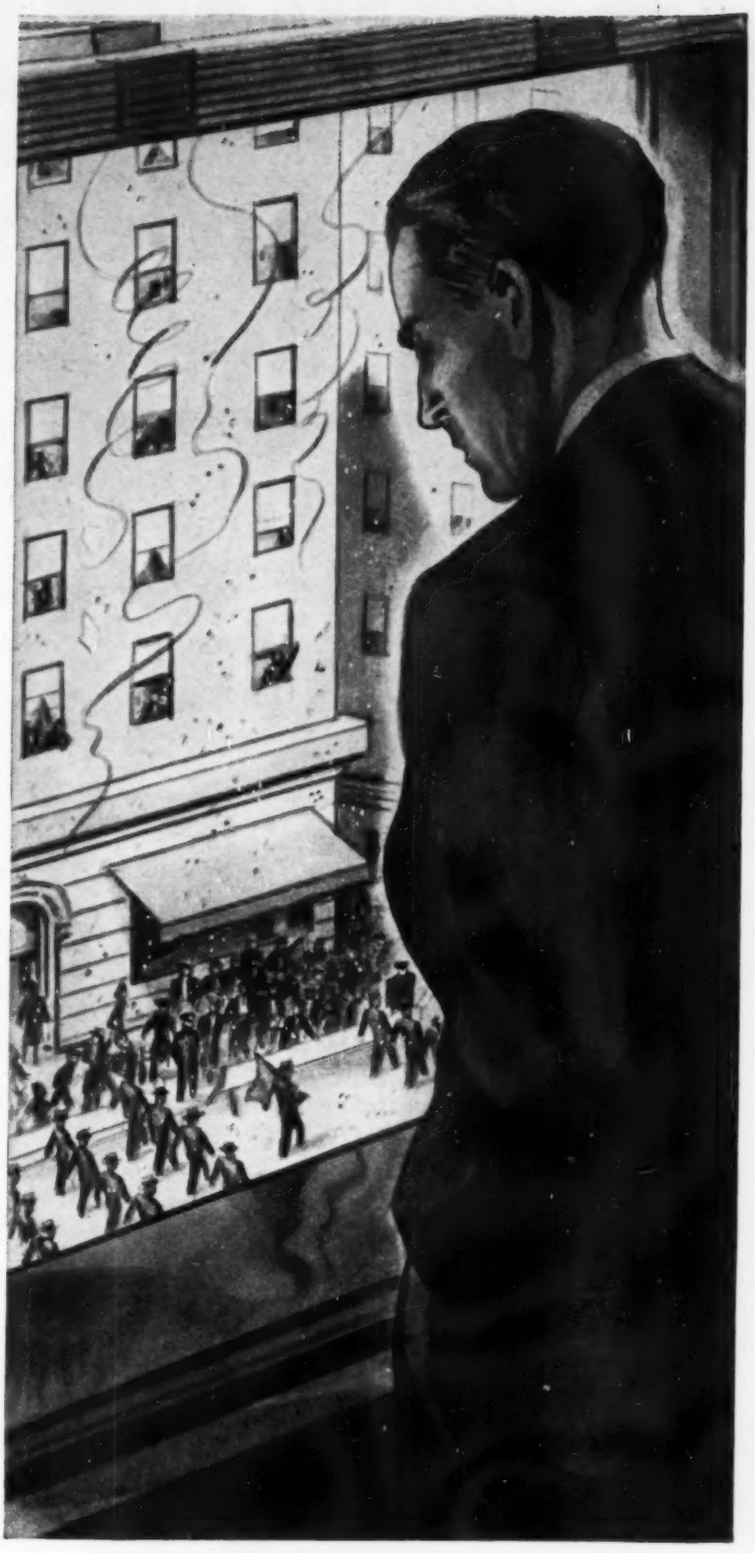
Milling, drilling, boring and shaping at all angles of the work can all be handled on the "Bridgeport" without changing set up. Furthermore, each of these operations is handled with equal convenience, accuracy and speed. Change from operation to operation is quick and easy. That the "Bridgeport" is fulfilling a definite need in modern production is attested to by the more than 9,000 units now serving throughout the metal working industry. *Get full details of "The Machine of Tomorrow. . . . Available Today."*

SPECIFICATIONS

Longitudinal Feed . . . 20" with standard 32" table
Cross Feed . . . 9"
Vertical Feed of Knee . . . 16"
Tables 36", 42" and 48" available; also longitudinal power feed
Weight with Shaping Unit . . . 2000#.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut

MEMO TO PRESIDENTS WHO WATCHED THE BAND GO BY!



HERE'S ONE parade that isn't "all over but the shouting" after the band has passed. It's the Payroll Savings Plan for the regular purchase of U.S. Security Bonds by employees.

Though the formal spring campaign to sell Bonds is over, any company can still move forward with the parade. Right now thousands of companies are putting *additional push* behind their Payroll Savings Plans. Managements of many companies that have not yet participated are *now installing* the Plan.

It's a "look-ahead" plan, that benefits employee, company, and nation. Every $3 invested in Bonds pay $4 at maturity. Personnel records in the plants with active P.S.P. programs show improved employee attitudes—evidenced by less absenteeism and fewer accidents—as the individual's sense of security grows with Bond purchases. And every Security Bond dollar built up in the Treasury retires a dollar of the national debt that is potentially inflationary. It means less bidding-up of prices. Moreover, Bond buyers are better citizens because they have a tangible stake in the nation's future.

It's just as easy to take action now as when the campaign was at its height. Just call your Treasury Department's State Director, Savings Bonds Division, and ask for the material that helps to get a Payroll Plan started or to keep it rolling.

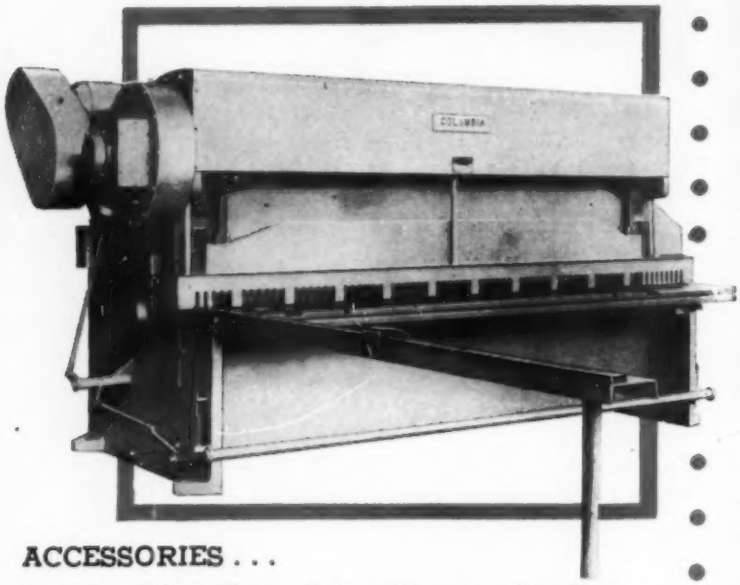
The Treasury Department acknowledges with appreciation the publication of this message by

American Machinist

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council.

IMMEDIATE DELIVERY

Columbia STEEL SQUARING SHEARS



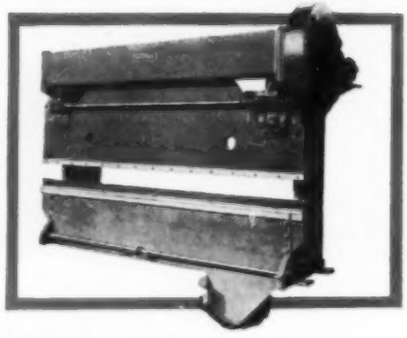
ACCESSORIES . . .

Micrometer Back Gauge, 24" or 36" range, adjustable in sixty-fourth inches. Provision for taper shearing. Front or back operation.

Squaring Arm of ten-foot-range, with steel scale and adjustable folding gauge finger, for use on either end of the shear.

Front Gauge with 50" range.

POWER PRESS BRAKES



Columbia Power Press Brakes, for forming mild steel, 4 to 10 feet, in 3/16" to 7/16" gauges, offer many cost-cutting advantages.

Write for Bulletins

COLUMBIA MACHINERY AND ENGINEERING CORPORATION

HAMILTON, OHIO

with all these ADVANCED DESIGN FEATURES

Greatly increased production which makes Columbia one of the nation's largest shear manufacturers makes possible IMMEDIATE DELIVERY of new post-war Columbia Steel Squaring Shears with all important design improvements you need for greatest shearing speed, accuracy and economy. It will pay you to investigate the experience of hundreds of Columbia users before buying. Note these Columbia features:

- **LONGER SHEAR BLADES** than are normally required for cutting full width of material eliminate tearing or nicking when notching or trimming sheets longer than blades.
- **ADJUSTABLE UPPER BLADE HOLDER** has a heavy brace with provision for readily adjusting horizontal alignment of blade.
- **RIGID STEEL CONSTRUCTION** of the base, housing, table, slide, top cross tie, etc., for maximum strength, durability and precision.
- **GEARS OPERATE IN OIL.** Steel gears, precision machine cut, operate in an oil-tight case.
- **SOLID, POSITIVE CLUTCH** has six alloy-steel jaws with hardened faces. Automatic stop cam.
- **HEAT-TREATED, FORGED ECCENTRIC SHAFT** — eccentrics forged integral with shaft.
- **MECHANICALLY-OPERATED AUTOMATIC HOLD-DOWN** has individual high-compression spring compensating fingers, insuring unfailing operation.
- **STAINLESS STEEL SCALES.** Non-rusting, easily-read.
- **CENTRALIZED LUBRICATION** for adequate, dependable lubrication to main bearings.
- **FINGER GUARD** in front of the shear blades.
- **CAPACITY.** 10 and 12 foot models will shear 3/16" mild steel at 60 strokes per minute. Six-foot models will shear 1/4" mild steel at same speed. Standard throat depth, 18 inches.

Christopher Columbus landing in the New World October 12, 1492.

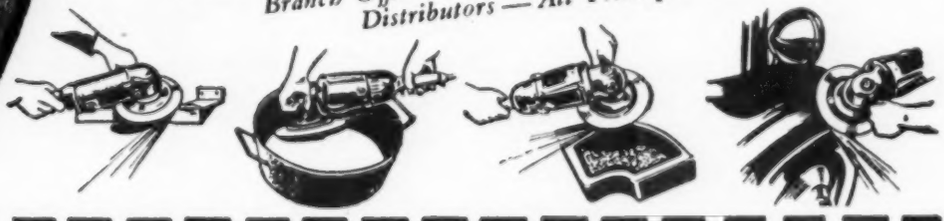
BAYFLEX is worth discovering too!

Columbus' discovery proved to be one of the most valuable discoveries in history . . . and *Bayflex Raised Hub Disc Wheels* have proved to be a remarkable "find" too, by foundries, welding shops, metal fabricating shops, automobile and truck body repair shops, for removing unwanted metal *faster — easier — cleaner*. Operators are pleasingly surprised with production possibilities and their increased piece-work earnings.

Bayflex discs 1/8" and thicker are made of multi-layers of cotton fiber loaded with sharp abrasive grit — flexible yet extremely strong — can be used for edge as well as surface cutting giving "40 to 1" life, and more, over conventional discs.

Words cannot fully describe this new wheel, you must see it in operation. Send coupon today for a demonstration.

BAY STATE ABRASIVE PRODUCTS CO.
WESTBORO, MASSACHUSETTS, U.S.A.
Branch Offices and Warehouses Chicago — Detroit
Distributors — All Principal Cities



BAY STATE®

Bay State Abrasive Products Co. Westboro, Mass.

Please have your representative call just as soon as possible to demonstrate Bayflex Raised Hub Disc Wheels. It is understood that this will not obligate us in any way.

Company.....

Street.....

City..... State.....

Individual.....

STANDARD Comparator DIAL SNAP GAGES

The efficiency of the STANDARD Dial Snap Gage is evidenced by the continual flow of repeat orders in large lots. Its simple, functional design, light weight, sturdiness and sustained accuracy, coupled with reasonable price have earned gratifying popularity in the most exacting plants. THIN . . . for use in narrow places; LIGHT . . . reducing the fatigue factor; PRECISE . . . easy to use, by the novice or expert, at bench or machine . . . and DEPENDABLE, ALWAYS!

1⅛" BEZEL

Small, light in weight, yet reading in .0001" with ease and proven precision.

SHOCKPROOF MECHANISM

STANDARD Shockproof construction absorbs shocks of sudden impacts without the slightest sacrifice of accuracy; assures high degree of consistent repeatability.

DIRECT ACTION

Plunger acts directly on indicator spindle, without intervention of levers; simple, dependable, avoiding loss of accuracy.

LONG LIFE ANVILS

Flat lower pin is tipped with tungsten carbide disc. Upper pin, as regularly supplied, has spherical surface, tungsten carbide tipped. If desired, gages can be furnished with two flat pins, lapped parallel, set and sealed.

Available in 8 sizes, each with range of 1". Design differs slightly with size, but accuracy is identical. Smaller sizes may be used in stands as comparators.

INSULATED GRIPS

Comfortable grips are heat-insulated from gage body to prevent hand warmth from affecting accuracy.

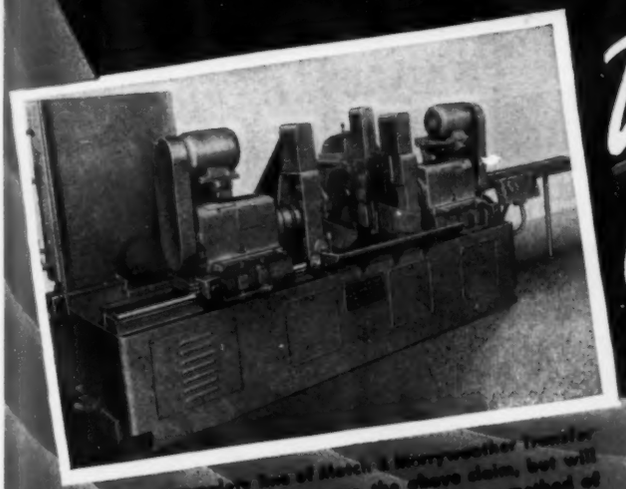
WRITE FOR COMPLETE INFORMATION

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

Triple-Chip METHOD

Using the Triple-Chip Method of Circular Sawing, we hereby undertake to cut your metal (*ferrous or non-ferrous*), to length, giving you a combination of *Speed, Accuracy and Low Cost*– not equalled by any other procedure.

Will You Accept Our Challenge?



The new, complete line of Motch & Merryweather Tramlo Machines not only will prove the above claim, but will introduce you to a startlingly new and better method of sawing to length and performing double end finishing operations.

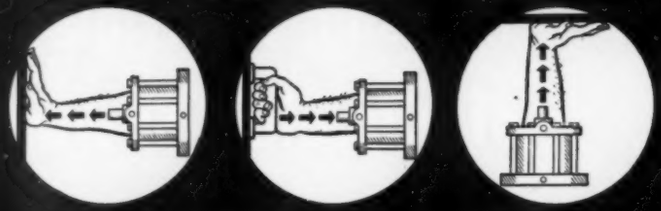
Only M & M builds ALL 3: CIRCULAR SAW SAW BLADE BLADE GRINDER

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING · CLEVELAND 13, OHIO

AT YOUR COMMAND · AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

PERFECT CONTROL

For PUSH-PULL-LIFT Jobs



with T-J CYLINDERS

More than a "muscle saver"—T-J Air and Hydraulic Cylinders give you *accurate automatic control* for operations of all kinds where pushing, pulling or lifting is needed.

Depend on T-J Cylinders to simplify machines . . . save time and labor . . . and do the job *right* at all times. Available in many standard sizes and styles . . . 100 lb. or 50,000 lb. . . . both cushioned and non-cushioned types. Precision-built with rugged dependability . . . backed by 31 years of know how. Write today for catalogs. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY

T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

Cut Your Costs by Redesigning for RETAINING RINGS

Gehl Harvesters and Hammer Mills are famous for their efficiency, rugged construction and continuous heavy duty service. By skillful designing for retaining rings Gehl Bros. Mfg. Co. of West Bend, Wisconsin saves metal, money and time. Perhaps you can too.

Hundreds of machines and products can and should be redesigned to take advantage of these inexpensive, yet highly efficient, artificial shoulders. Retaining rings are certain to save man hours as well as material.

To offset the rising costs of so many things here is one sure way to increase your margin of profit.

Don't cut down large shafts to make your shoulders—it's needless waste. Groove all shafts and housings and use these high grade steel rings.

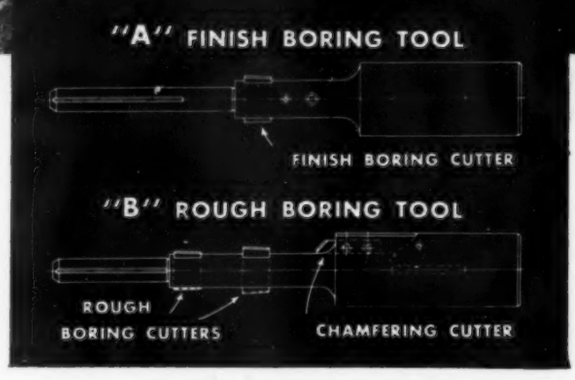
Examine your machines and products today, and send for a descriptive folder of our many types of retaining rings.

THE NATIONAL LOCK WASHER CO.

NEWARK 5, N. J. **MILWAUKEE 2, WISCONSIN**

MADISON *Boreaming increases parts production 70% for "EASY" washers

*Completed boring operation



Here's the story: An aluminum casting required the following operations on inside and outside diameters — Rough bore 1st ID — Rough bore 2nd ID — Finish 1st ID — Chamfer ID — Face Shoulder — Turn 1st OD — Turn 2nd OD — Finish 1st OD — Finish 2nd OD — Thread 2nd OD.

Using single point tools, all six of the turret faces were required to finish a single casting. 19.7 parts per hour were completed.

With Madison Boreaming, EASY WASHING MACHINE CORP. was able to accomplish the same machining on three turret faces, permitting two completed castings per turret revolution. 33.6 parts per hour were completed.

Thus with two Madison tools EASY gained a production increase of 70.5%. Why not put Madison Boreaming to work for you? Write for the new Madison Catalog. It shows complete lines, prices and grinding instructions.

Write for the Madison catalog today. Get the facts on Madison Boreamers, the tools that make one operation out of boring and super finish reaming.

MADISON MANUFACTURING COMPANY
DEPT. AM-1 MUSKEGON, MICHIGAN

Balanced load!
TWIN POST MOUNTING
Means Accuracy
IN TOP-SPEED MILLING
Kent-Owens Machines do your milling right—with speed and accuracy that means greater production, fewer rejects, lower costs! The head is mounted on two cylindrical ground steel posts which carry the spindle midway between them—an exclusive Kent-Owens feature! No overhang—no cocking action. It's extra rigid . . . practical . . . dependable. Write for bulletins on wide range of hydraulic and hand-operated machines. Kent-Owens Machine Co., Toledo, Ohio.
Call on
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NO. 1-14
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Milling Machine
. . . 32" x 9" table
. . . 14" table travel

"600" has been successfully used for many years as the solution to many extremely difficult bearing problems. It is a true bearing metal and—an entirely different one. "600" can be drawn or forged and readily fabricated in a great variety of sizes and shapes.

Many thousands of auto and truck transmissions have their reverse idler gears running on shafts of "600". A large quantity of it has been very successfully used for pump rods and other purposes where lubrication may be neglected.

"600" IS IDEAL FOR PROPELLER SHAFTS IN POWER BOATS AND HUNDREDS OF OTHER USES, SUCH AS SPINDLES, SEAL RINGS, BEARING RINGS, WORM GEARS, CONNECTING RODS, CAMS, THRUST WASHERS, SUPERCHARGER SHAFTS, ELECTRICAL, AIRCRAFT AND AUTOMOTIVE EQUIPMENT, CONTROL APPARATUS AND MARINE HARDWARE.

"600" SERIES

BEARING METAL *FOR TOUGH JOBS*

- High strength
- Resistance to wear
- Corrosion resistant

LIGHTER WEIGHT

Higher speeds and lighter weights are being demanded by leading designers of the most modern equipment. "600" Metal is specified for bearings because of its adaptability to meet the most exacting requirements. "600" Metal is approximately 8% lighter in weight than phosphor bronze alloys.

If you have a bearing problem, write us. We will supply you with samples of material for testing your own application. A complete booklet on "600" Series Alloys is yours for the asking.

MUELLER BRASS CO.

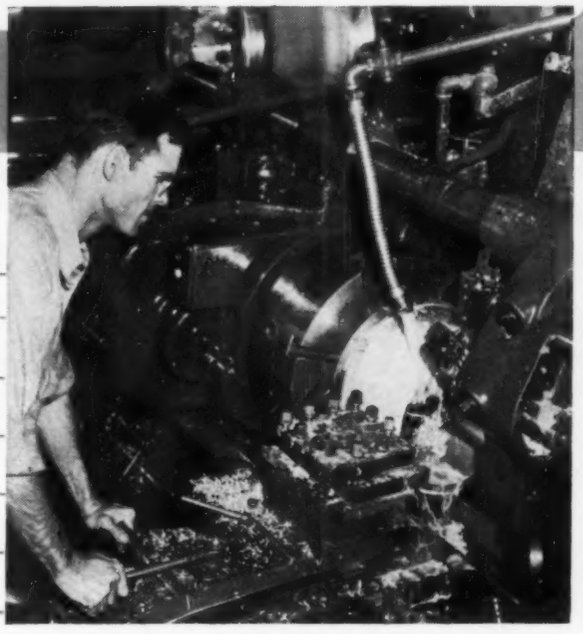
PORT HURON, MICHIGAN •

Properties that *Count* in a soluble oil ✳

You get them all in

GULF SOLUBLE CUTTING OIL ✳

- ✳ Helps keep cutting tools sharp, grinding wheels clean
- ✳ Highly stable — in use or in storage
- ✳ Helps prevent gummy deposits
- ✳ Helps prevent rust
- ✳ Emulsifies readily with all but the hardest water
- ✳ Clean, pleasant odor — ready operator acceptance
- ✳ Nonfoaming



Facing and turning operation on steel forging, typical of the diversified machining jobs where Gulf Soluble Cutting Oil helps improve production and increase tool life.

THESE properties are combined in Gulf Soluble Cutting Oil to help you get greater production efficiency over a wide range of cutting, milling and grinding operations.

Call in a Gulf Lubrication Engineer and ask him to recommend the proper concentrations of Gulf Soluble Cutting Oil for your particular requirements. For further information on Gulf Soluble Cutting Oil—and for one of Gulf's practical slide-rule-type calculators, which will help you maintain desired soluble oil concentrations—send the coupon at right.

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- ☐ Further information on the new Gulf Soluble Cutting Oil.
- ☐ Practical slide-rule-type calculator for help in maintaining desired soluble oil concentrations.

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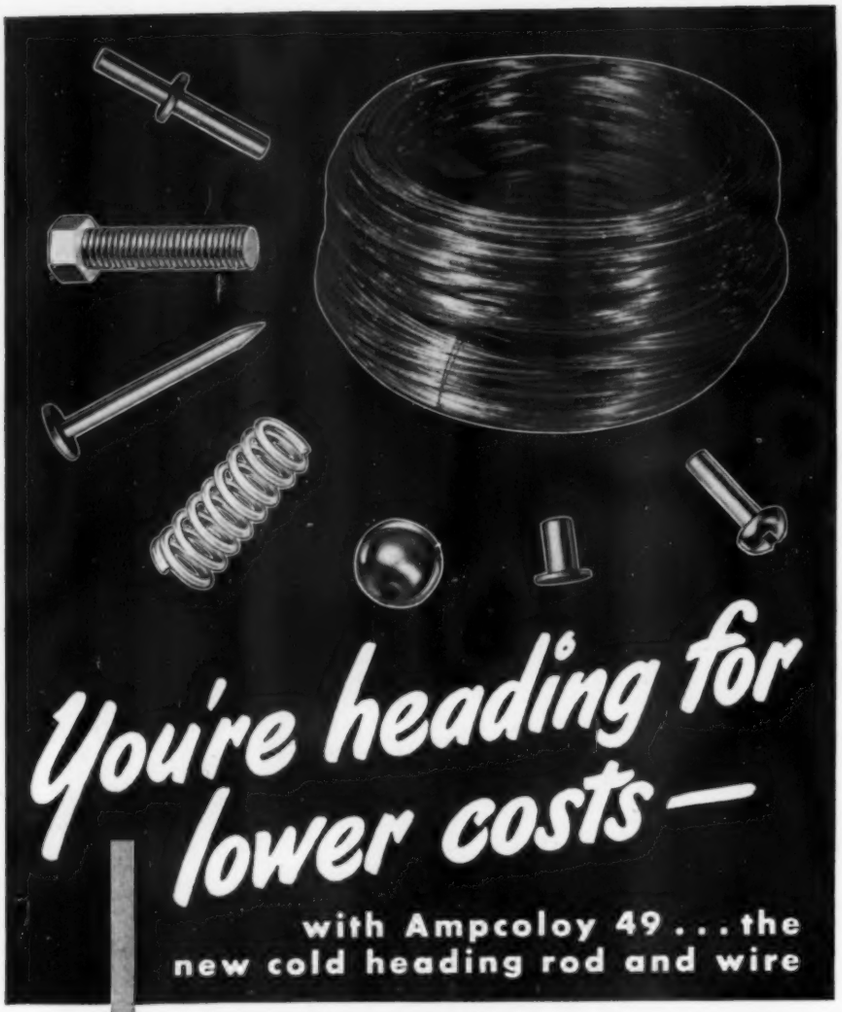


You're heading for lower costs—

with Ampcoloy 49 . . . the new cold heading rod and wire

. . . . This new aluminum bronze alloy combines ductility for cold heading and high strength-weight ratio for economy

HERE'S the first real answer to your demand for an aluminum bronze suitable for cold heading — Ampcoloy 49. It is alloyed specifically to provide the ductility that cold heading requires. Light in weight and strong, as are all aluminum bronzes, Ampcoloy 49 is still further improved by cold working.

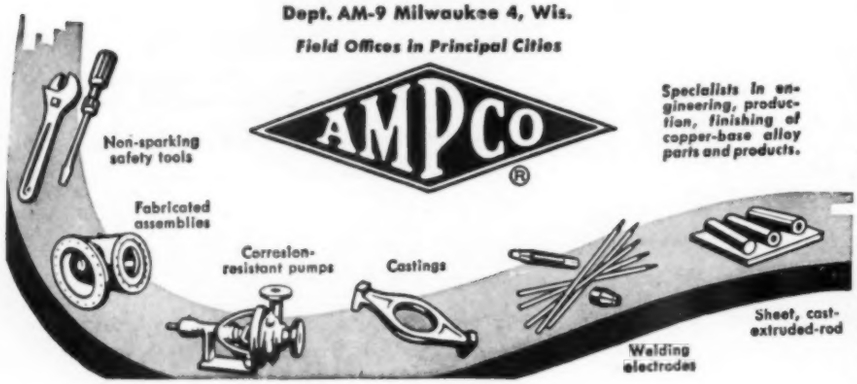
You can get Ampcoloy 49 as extruded solid rod in diameters up to 3", or in 100-pound coils of cold-heading wire, sizes from .125 to .420 gauge.

Use Ampcoloy 49 for economical cold-heading production of bolts, rivets, screws, and similar fastenings. Take advantage of its excellent spring characteristics, its corrosion resistance, and its weldability. It can be cold-coined, cold-forged — and annealed, if it is desirable to change its physical properties. And in every application, you have the advantage of the clean, sound grain structure and close tolerances delivered by the extrusion process. For complete information on Ampcoloy 49, write for Bulletin 88.

Ampco Metal, Inc.

Dept. AM-9 Milwaukee 4, Wis.

Field Offices in Principal Cities



"Well, I thought I was, too, a long time ago, but I found out that there's an awful lot to this cutting fluid business. It takes a combination of understanding and experience backed by adequate laboratory facilities to determine the needs of a modern metal-working plant. That's why I rely on experienced cutting oil people. They have helped me time and again with sound ideas and practical solutions to difficult machining problems. They've proved to me that the correct cutting fluid, correctly applied, means less trouble and fewer headaches. For guidance on this, give me the *real* 'experts' every time."

—Chip

Call D. A. Stuart Oil Co. when you need expert assistance. Since 1865, this company has devoted its entire interest to cutting fluids and industrial lubrication. We pride ourselves on the quality of our products and the engineering ability of our representatives. Take advantage of Stuart's complete on-the-spot service and laboratory facilities to solve your cutting fluid problems. Write for booklet "Cutting Fluids for Better Machining."

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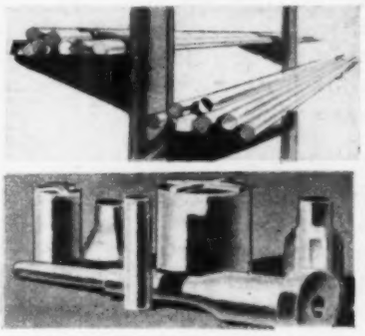
AXELSON FIRST CHOICE

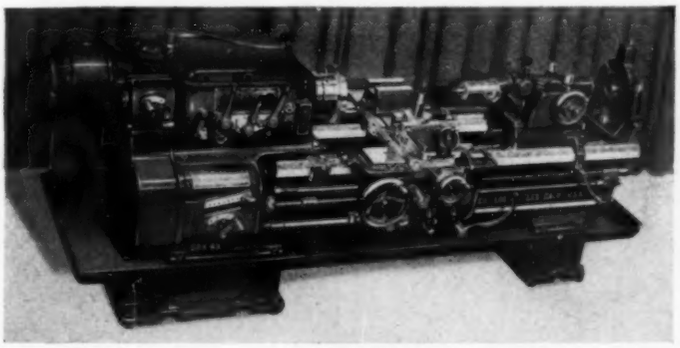
SHOP SUPERINTENDENTS AGREE that machinists produce more work of higher quality with fewer rejects on AXELSON engine lathes, because of their infinite ease of operation, greater versatility, and in-built precision. Control of manufacture... from foundry to assembly... makes this possible.

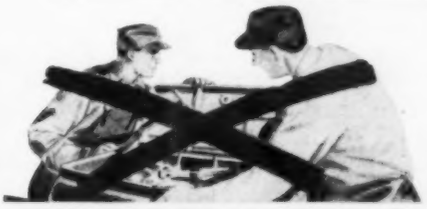
MORE PRODUCTION PER MAN-HOUR results when a job goes on an AXELSON lathe... machinists actually like to operate them... location of controls minimizes lost motion... extreme rigidity permits faster speeds... ample smooth power for the deepest cut without slowdown.

GREATER ACCURACY MEANS FEWER REJECTS... Massive bed designed to maintain absolute alignment... spring tension scrapers and felt wipers on carriage prevent dirt and chips from galling the ways... operator has complete, precision control of the cutting at all times.



ADAPTABLE TO ANY STOCK, JOB OR TOOL... Wide range of speeds and feeds... two-speed tailstock is standard equipment... with ram type turret, power rapid traverse, micrometer carriage stops, relieving and taper attachments, and many other accessories available for handling any work... designed to use all modern tooling.





MINIMUM MAINTENANCE AND REPAIR... Easier to tool-up and retain precision settings... forced-feed lubrication to carriage and cross slide ways, eliminates wear — gibbed slides permit easy compensating adjustments... all parts designed for longest life with the least maintenance.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

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TWENTY WAYS
TO DO GRINDING JOBS BETTER AND FASTER!

STERLING'S STERMOUNTS offer positive solutions for your perplexing, difficult grinding and polishing jobs. The twenty shown to the right are but a few of many shapes and sizes which are available to use in those hard-to-get-at locations where good grinding seems impossible.

Sterling's Stermounts are made in both vitrified and resinoid bonds to widen their usefulness for grinding all types of metals . . . they have the correct outlines to fit into all types of holes and recesses.

Sterling's Stermounts have the added advantage of removable spindles that can be used over and over again. These spindles are made in two sizes to add extra rigidity and safety to the Stermounts when they are in use.

Sterling's Stermounts hold their cutting qualities and do a quick job on all kinds of metals without undue pressure being exerted. They are sturdy and tough . . . provide long grinding life.

Want to cut costs with Stermount? Drop us a line today, and we will tell you how to do it.

"THE WHEELS OF INDUSTRY"

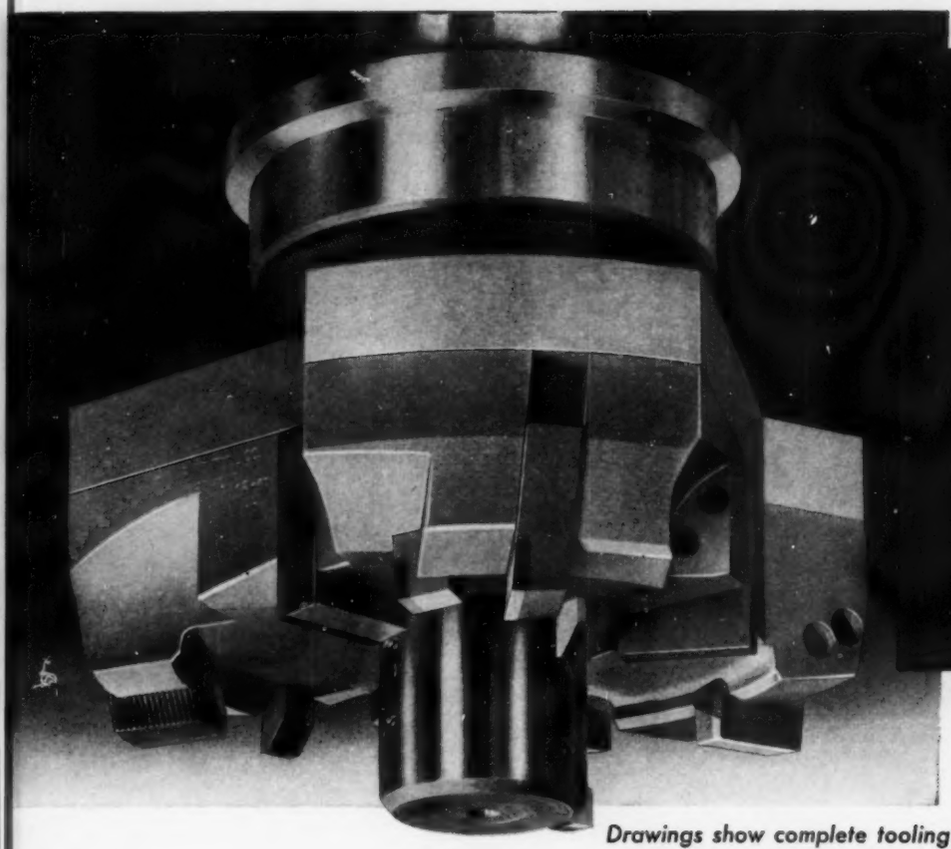
Sterling

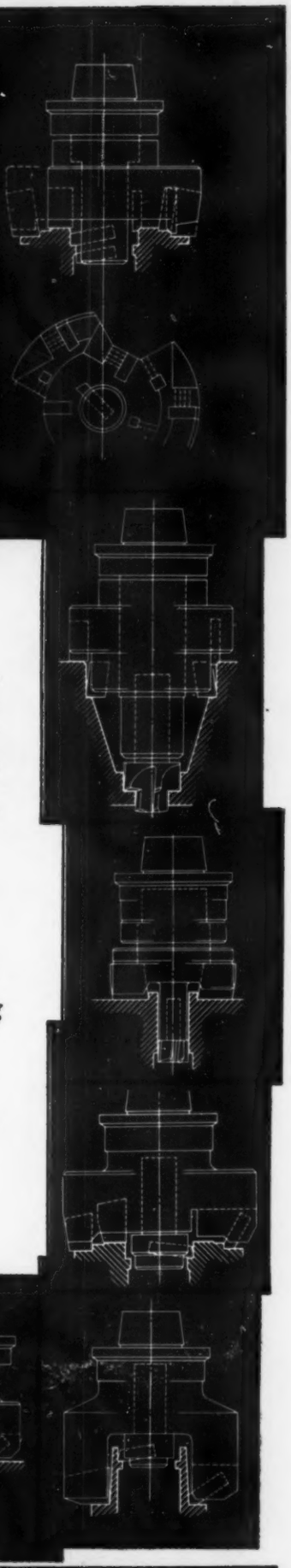
● The complete Stermount line of wheels and shapes is shown in this attractive folder which is available for distribution. Send for your copy . . . it gives measurements and prices of each type . . . describes the spindles, too!

· STERLING ABRASIVES ·

THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY





Drawings show complete tooling for a two-way, trunnion-type, four-spindle, roughing and precision boring machine, producing power take-off units. Each tool performs one or more operations such as boring, counterboring, chamfering, facing, and hollow milling.

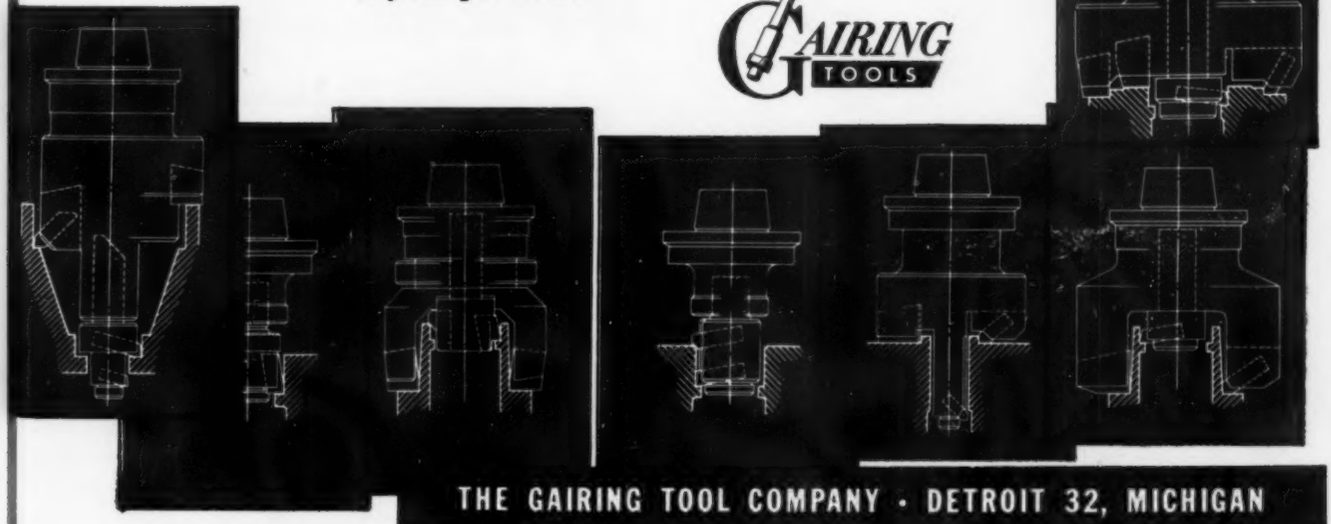
Multiple Tooling

More precision parts at lower costs are made possible through specially designed inserted blade cutting tools.

This actual example of multiple tooling recently completed by GAIRING suggests how the use of sound and proven principles of cutting tool design might improve the production of *your* machines.

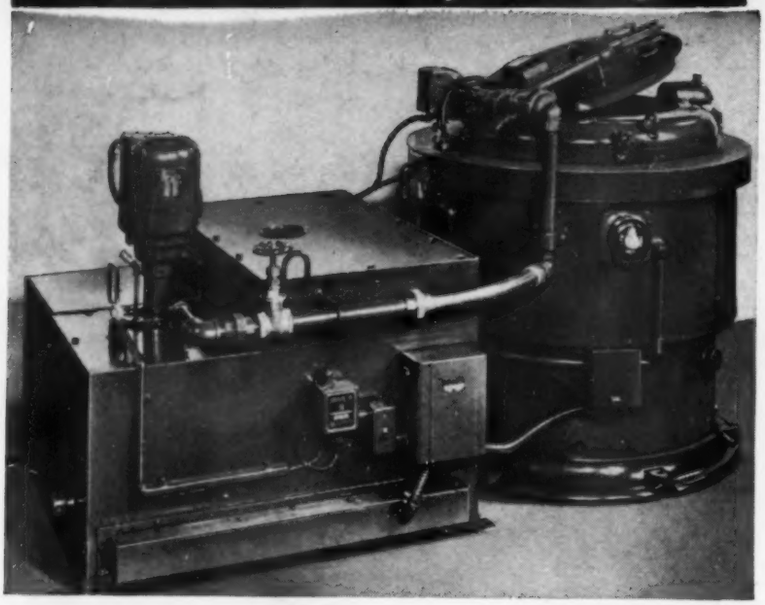
So, if your present production falls short of expectations, let GAIRING'S engineers make a comprehensive analysis of your problem.

GAIRING TOOLS



THE GAIRING TOOL COMPANY · DETROIT 32, MICHIGAN

CONTROLLED IMPREGNATION by the BARRETT "HYDEWA" Centrifugal Process offers many advantages



The Centrifugal Process is limited in application only to the size of the articles that may be rotated in fair balance in the revolving bowl. Coils, condensers, transformers, braiding cotton insulated wire, paper tubes, pressboard spacers, rawhide and bristles, are but a few of the many typical products now being processed in Barrett Impregnators. Many products heretofore considered impractical for satisfactory impregnation by other methods have been successfully handled.

The Barrett Method assures fast production, by reducing the customary hours to minutes, high penetration, with controlled impregnation, also positive expulsion of air from the articles being impregnated.

Basic units are self-contained, direct motor driven. Special arrangements and supplemental equipment also provided.

Submit your problem and samples for test and recommendations.

THE LEON J. BARRETT COMPANY, 1800 Grafton Road, **WORCESTER, MASS.**

Designers and Builders of Centrifugal Machinery

BROACH YOUR *Small Parts* AT A NEW LOW COST with the *Zagar* "S.P." HYDRAULIC BROACHING MACHINE

WHY take chances with obsolete methods. Maintain accuracy and finish . . . and produce all around better work on a compact, powerful and inexpensive Zagar Broaching Machine. Maximum capacity 12,000 lbs., variable speeds 30' per minute maximum with 20" stroke. Weighs hardened and ground with adjustable gibs. *Low Initial Cost* and *Minimum Maintenance* make the Zagar Broaching Machine a *Profitable Investment* for any plant regardless of size.

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Zagar ZAGAR TOOL, INC. 23880 Lakeland Blvd. · Cleveland 23, Ohio

PRODUCTION TOOLING FOR INDUSTRY

GET THE WHOLE STORY *of* SERVICE WITH A *Punch!*

Allied's 48-page R-B catalog contains complete data and prices on R-B Interchangeable Punches and Dies—recognized and used for accurate, trouble-free punching throughout the metal-working and plastics industries. But that is only part of the R-B story. Also included in this catalog is full information on Allied's "one stop service" which includes retainers, composite die sections, rubber strippers, guide pins and bushings, and miscellaneous die makers' supplies. A copy is available to you without charge or obligation. *Write for it today.*

ALLIED PRODUCTS CORPORATION

Department 23
4612 Lawton Ave. • Detroit 8, Mich.

Your Source of Supply for Better Taps

There are many sources of supply for standard taps . . . also varied degrees of quality in manufacture. The only way to determine *your* best source is by (1) reputation of the manufacturer in the trade, (2) your on-the-job performance of the taps you buy on the basis of tapping cost per hole.

However, if you run into troubles, it is far better practice to consult *your* manufacturer, stating the trouble in detail and requesting a solution. Hanson-Whitney engineers welcome such inquiries . . . in fact, we request them. We stand firmly back of Hanson "Finished Taps" of both Standard and Special make.

And as for "Specials," you'll find no *better* source of supply anywhere.

Measurement of Tapping Costs

Economy of tapping is measured only by the cost per tapped hole . . . not by the cost of the taps themselves.

In high speed tapping the Hanson-Whitney "Finished Taps" clearly demonstrate their superior value both for accuracy and economy. The accuracy with which they are made results in long tap life, minimum breakage, and perfect threads. It naturally follows that they are the most economical to use.

Explain Your Job in Detail . . . We'll Serve You Better

When ordering, specify grade of material to be tapped, depth of tapped hole, class of fit and whether through hole or bottoming. With full information we can give you correct hook or rake on cutting faces, number and style of flutes and proper chamfer. Thus you obtain the right tap for the specific operation . . . lower costs, quality threads.

If your tapping problem involves bottoming holes . . . or deep holes . . . the solution may be in the use of a Hanson-Whitney spiral flute tap that is most effective when made by the Hanson-Whitney method, and with the Hanson-Whitney background of "ground after hardening" experience.

The spiral flute tap, made with flutes and threads of the same hand, draws the chips *from* the hole. This prevents chip clogging and provides free flow of coolant.

HANSON-WHITNEY MACHINE CO. HARTFORD 1, CONN.
Division of Whitney-Hanson Industries, Inc.

For practical recommendations submit your problems to Hanson-Whitney engineers.

Hanson Whitney
PIONEERS OF FINISHED TAPS

ADVERTISEMENT

Staples SETS A RECORD LOW In Carbide Reamer Prices

New ECONOCUT CARBOLOY-TIPPED CEMENTED CARBIDES REAMERS

Again, Staples Tool Company leads in reducing *metal cutting costs*—with the new line of ECONOCUT Reamers. These precision Carboloy-tipped tools are now available for immediate delivery at the *lowest prices ever announced* in circular carbide tool history!

Now you get carbide reamer economy, better hole finish, longer tool life—at greatly reduced prices. Staples has made this cost reduction possible through expanded and improved production facilities —and by standardizing ECONOCUT on straight shank tools in the most widely used size range. See your Staples Tool Distributor, or write for further information.

STRAIGHT SHANK—STRAIGHT FLUTES				
Diameter	Number of Flutes	Shank Diameter	Overall Length	PRICE
1/4"	4	15/64"	6"	$3.75
9/32	4	15/64	6	4.00
5/16	4	9/32	6	4.00
11/32	4	9/32	6	4.25
3/8	4	5/16	7	4.25
13/32	4	5/16	7	4.75
7/16	4	3/8	7	4.75
15/32	4	3/8	7	5.00
1/2	6	7/16	8	5.50
17/32	6	7/16	8	5.75
9/16	6	7/16	8	5.75
19/32	6	7/16	8	6.25
5/8	6	9/16	9	6.25

NOTE: For taper shank requirements, use standard split sleeve reamer driver. Available at moderate price.

THE STAPLES TOOL COMPANY
CINCINNATI 25, OHIO

write for your complete Staples Tool catalog

Staples CARBOLOY CEMENTED CARBIDE TOOLS

A COMPLETE LINE OF SINGLE AND MULTIPLE POINT CUTTING TOOLS
EXPANSION REAMERS • FORM TOOLS • CENTERS • MASONRY DRILLS • SPECIAL TOOLS

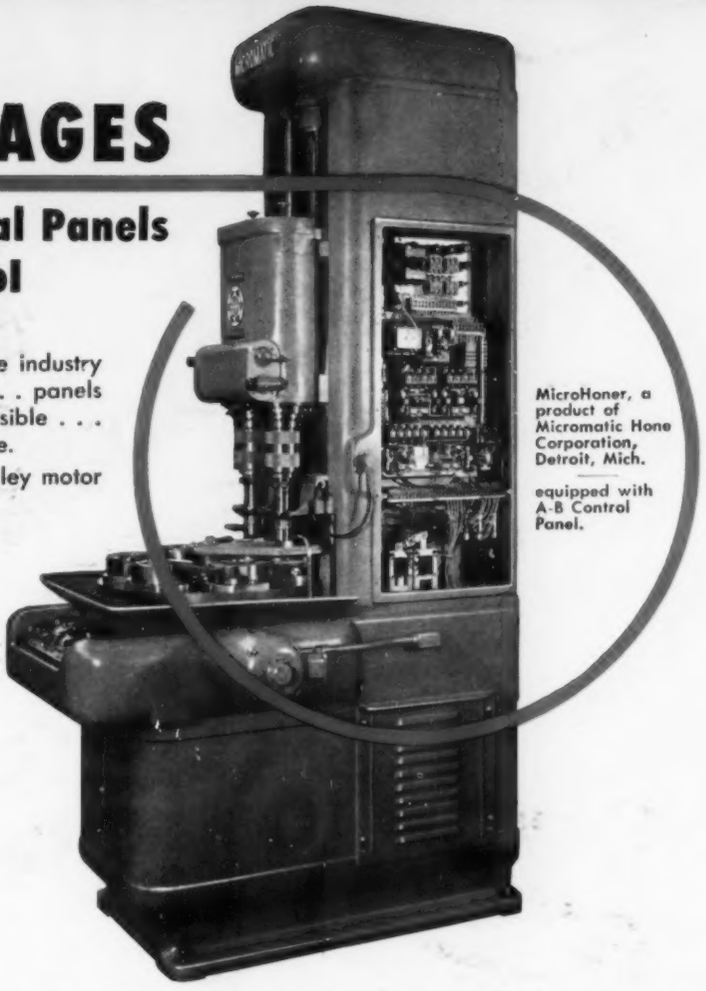
8 BIG ADVANTAGES

of Allen-Bradley Special Panels for Machine Tool Control

With multi-motion machine tools, the trend in the industry is toward special panels for all motor controls . . . panels that fit into machine frames wherever this is possible . . . and designed for maximum machine performance.

Consider these 8 big advantages of Allen-Bradley motor control panels:

1. All control units on one panel . . . easily accessible . . . readily enclosed for complete protection.
2. With the wide variety of control units available, any sequence operation can be worked out to fit the precise needs of the machine function.
3. Consistent and accurate sequence control, because all units are similar in construction and performance.
4. Dependable operation, because A-B solenoid controls are trouble free . . . a vital asset for machine tools.
5. Allen-Bradley solenoid switches eliminate contact maintenance. All switches have silver-alloy contacts. Double contacts reduce wear materially.
6. Allen-Bradley special panels are space savers. A-B units, generally the most compact on the market, can be mounted close together on steel panels.
7. A-B panels dispense with engineering risks and experimental expense. Panels are tested for the specified sequence operation. All A-B controls are time tested and reliable.
8. Allen-Bradley control panels are a sales asset to any machine, because Allen-Bradley controls are virtually the standard of the machine tool industry.



MicroHoner, a product of Micromatic Hone Corporation, Detroit, Mich.

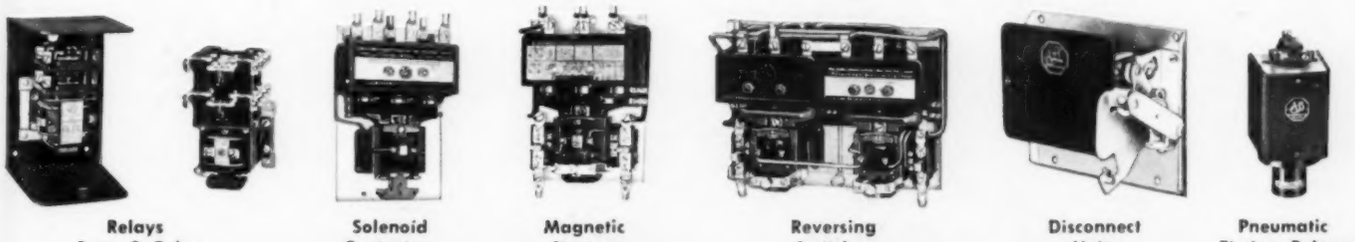
equipped with A-B Control Panel.

To give your customers the full advantage of your completely automatic machine tools, make Allen-Bradley special panels your standard. They are engineered to fit the needs of your machines. Wiring errors are eliminated, appearance of the machines is improved greatly, and dependability of performance . . . so vital in high-production plants . . . is assured.

It will pay you to investigate the many advantages of Allen-Bradley special panels. Let us engineer your next machine tool control.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

Typical A-B Control Units for Special Panels

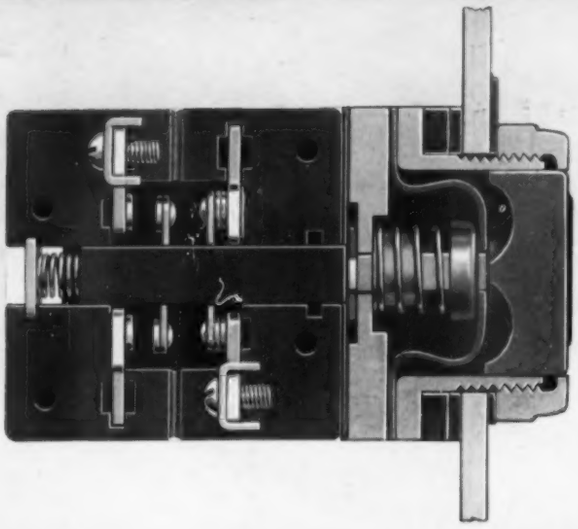


Relays 1 to 8 Poles | Solenoid Contactors | Magnetic Starters | Reversing Switches | Disconnect Units | Pneumatic Timing Relays

ALLEN-BRADLEY

SPECIAL PANELS

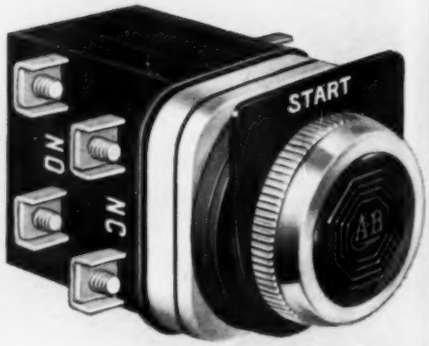
QUALITY



At left: Sectional view of Allen-Bradley Oiltight Push Button. Flexible diaphragm and panel gasket exclude cutting fluids.

Below: Assembled view of the same push button.

OILTIGHT CONTROL UNITS for Machine Tool Control



START BUTTON | STOP BUTTON | JOGGING BUTTON | MUSHROOM BUTTON | SELECTOR SWITCH | PILOT LIGHT

Bulletin 800T Oiltight Push Buttons. Send for your copy.

For machine tools and similar equipment, flooded with cutting fluids, Allen-Bradley Bulletin 800 Oiltight Control Units are a basic requirement.

These attractive-looking control units are compactly designed. They consist of one or two contact blocks combined with a variety of operators (illustrated above) to meet any need. Each block has one normally open contact and one normally closed contact.

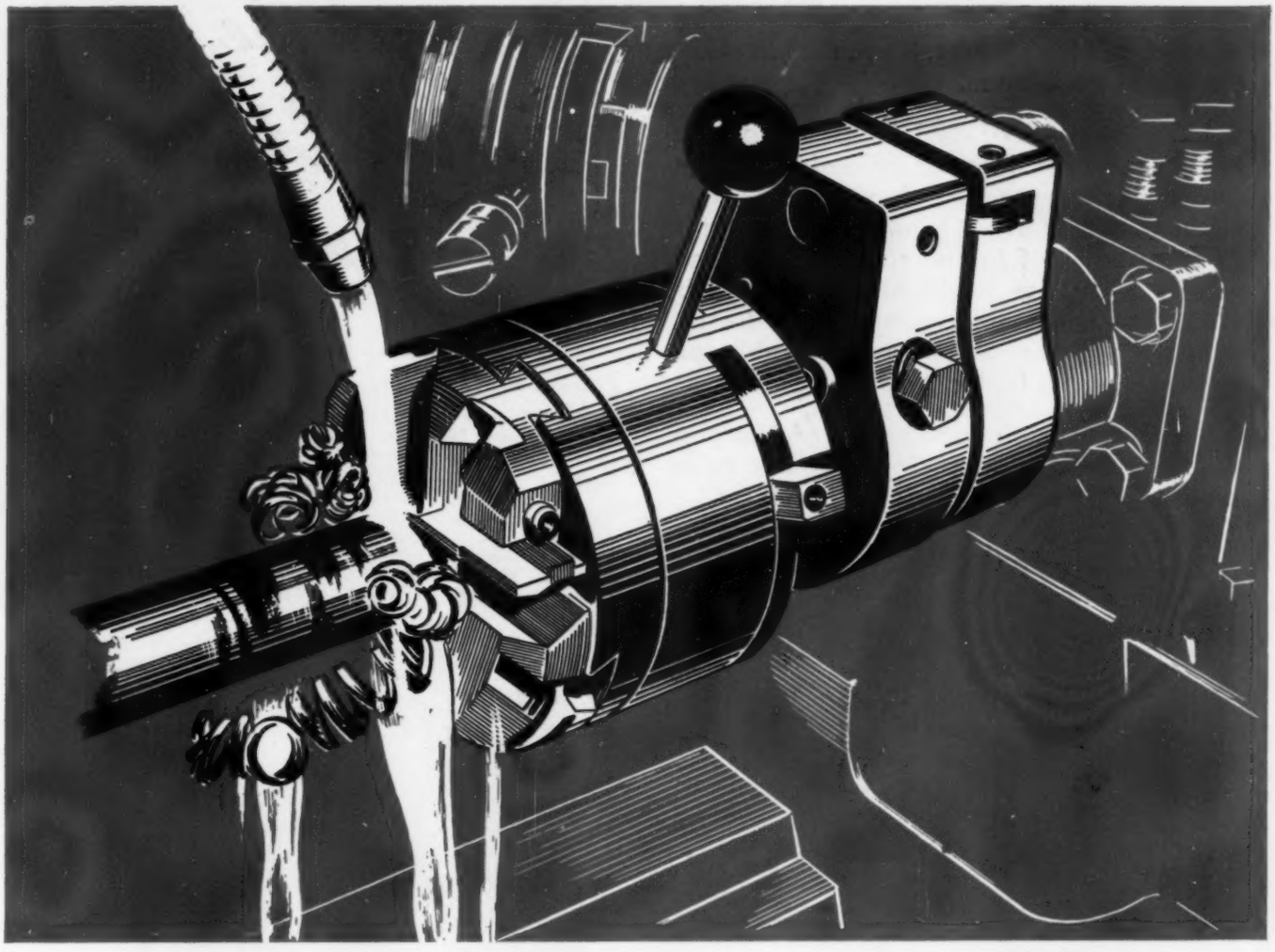
Allen-Bradley Oiltight Control Units are mounted in a single hole, notched to prevent turning. These oiltight units can be grouped closely on a control panel or machine base. The push buttons are available with black or colored buttons—green, blue, brown, yellow, orange, and gray. Pilot lights can be supplied with blue, red, green, amber, clear, and white bezels. Jogging button or selector switch also available. Write for Bulletin 800T. Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.

A-B Quality

ALLEN-BRADLEY

QUALITY OILTIGHT CONTROL UNITS

YES! Tycol Amulkut Cutting Oils perform better . . . BETTER . . . BETTER



Tycol Amulkut Cutting Oils perform better because:

. . . *Tycol Amulkut Cutting Oils* are specially designed soluble oils, forming stable emulsions with water of normal hardness.

. . . *Tycol Amulkut Cutting Oils* boost production by permitting easier, faster cutting . . . assure better machine finishes.

. . . *Tycol Amulkut Cutting Oils* save you money by minimizing spoilage, lengthening tool life and reducing oil consumption.

For complete information about Tycol Amulkut Cutting Oils and the other lubricants that make up the complete Tycol line, write your nearest Tide Water Associated Office today.

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia
Chicago • Detroit • Tulsa
Cleveland • San Francisco

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N.Y.

LUBRICATION — "ENGINEERED TO FIT THE JOB"

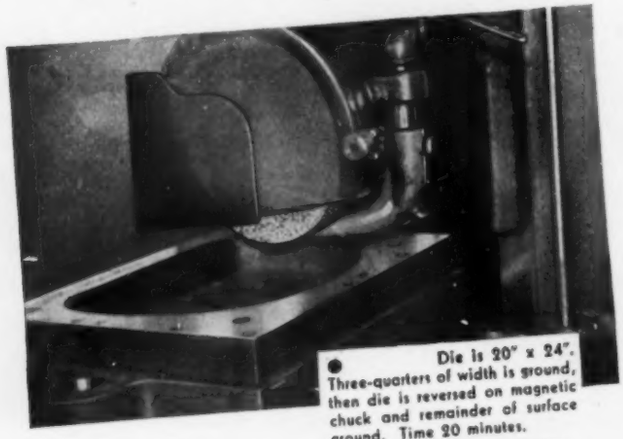
'TIME OUT' FOR DIE RECONDITIONING HELD TO A MINIMUM

with the Mattison Grinder

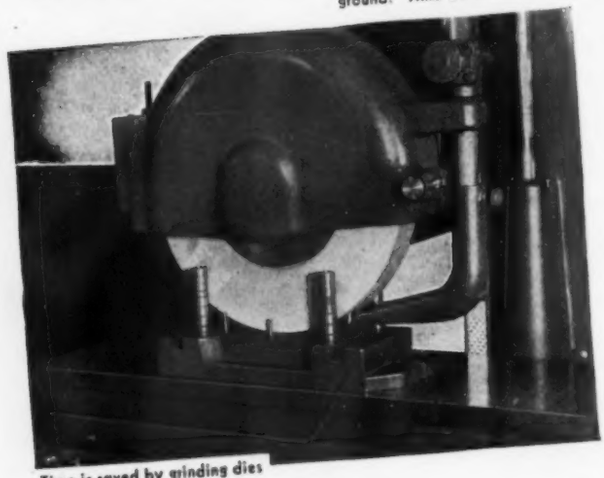
A GREAT variety of die work can be speedily and easily handled on the Mattison Surface Grinder. Its large capacity, ability to hog off stock and high power, keeps the 'time out' periods to a minimum.

A few examples of die jobs ground on the Mattison at a considerable saving in time, are shown on this page. Die shown in the lower left hand corner was ground with leader pins in place at $\frac{1}{3}$ of former time. Wheel and spindle clearance of Mattison Grinder is sufficient to handle this type of work with ease, eliminating time required for disassembly and alignment when leader pins are removed.

For further data regarding use of Mattison Grinders for reconditioning dies, ask us to send you free set-up book on this subject.

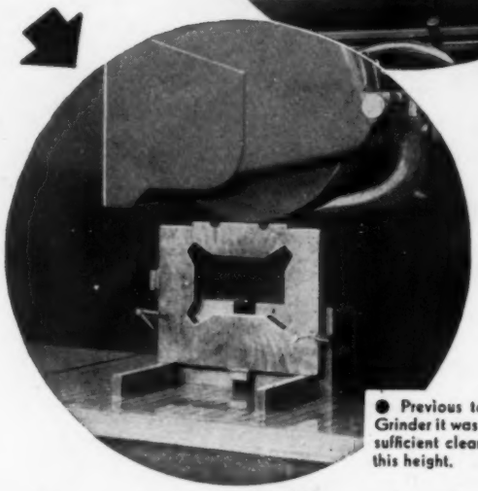


● Die is 20" x 24". Three-quarters of width is ground, then die is reversed on magnetic chuck and remainder of surface ground. Time 20 minutes.

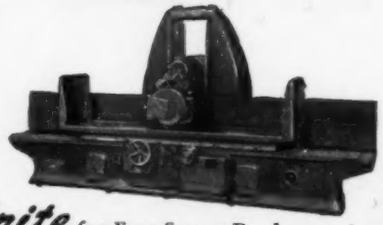


Time is saved by grinding dies with leader pins in place.

● Material: Hardtem Steel Forging die.
Stock Removed: $\frac{1}{64}$" from face side.
Present Time: 8 minutes.
Previous Time: 30 minutes.



● Previous to obtaining Mattison Grinder it was not possible to obtain sufficient clearance to grind dies of this height.



Write for Free Set-up Book containing further examples, showing how others have reduced time and cut costs with Mattison Grinders.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

STANDARD
for tough jobs

Preferred, specified and used in mass production by—

- The Automotive Industry
- The Aviation Industry
- The Electrical Industry
- The Farm Implement Industry
- The Home Appliance Industry
- The Railway Industry

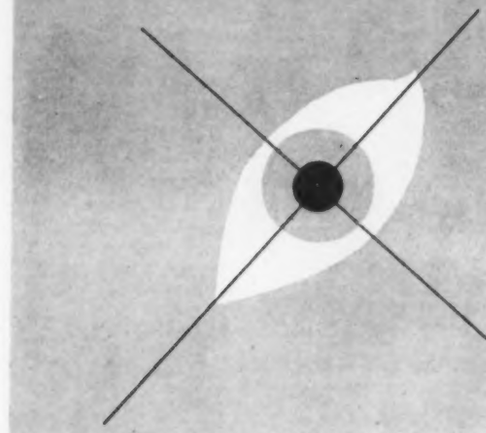
Sold by Leading Mill Supply Distributors Coast to Coast.

STANDARD TOOL CO.

THE STANDARD TOOL CO.
CLEVELAND

Warehouses: New York · Detroit · Chicago

THE STANDARD LINE · Drills · Reamers · Taps · Dies · Milling Cutters · Special Tools



Watch and Wait for the **NEW**

COULTER conventional type **THREAD MILLING MACHINE**

The machine that will produce long or short precision traversing, elevating, cross feed and lead screws in less time than any other method.

It has a new type cutter head, sturdy construction, high spindle speeds are used with carbide tipped cutters.

the James COULTER Machine Co.
BRIDGEPORT, CONN.

Here's How... to do every swaging job.

ETNA

ROTARY SWAGING MACHINE

6000 HAMMER BLOWS OF INFINITE FORCE PER MINUTE

- The dies and hammers rotate around the work, which is held stationary, quickly swaging it to desired size and shape.
- Built to handle the severest work with capacities up to 14 inches in diameter.
- Integral forced coolant and lubrication systems.
- Handle hot or cold work.
- Readily equipped with a variety of feeding devices.
- Cast alloy steel drum mounted on base and bolted to front housing.
- Timken bearings take spindle thrust. Radial ball bearing in rear of flywheel.
- Alloy steel forged, heat-treated and ground spindle.
- A taper fit is used for the flywheel which is further secured by a split nut and key.
- Hammers, rolls and inner ring of heat-treated alloys.
- Motor is mounted over the machine on an adjustable bracket, the power being transmitted by V-belts.

WRITE FOR DESCRIPTIVE LITERATURE

THE ETNA MACHINE CO.

3409 MAPLEWOOD AVE. · TOLEDO 10, OHIO

DIAMONDS FOR WHEEL DRESSING TOOLS
DIAMONDS FOR THREAD GRINDING TOOLS
DIAMONDS FOR ALL INDUSTRIAL PURPOSES

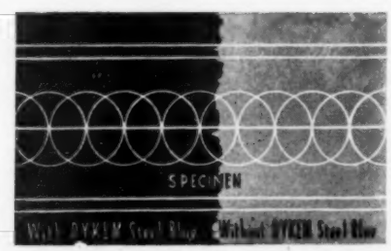
KOEBEL

Koebel Diamond Tool Co., 9456 Grinnell Ave., Detroit 13

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



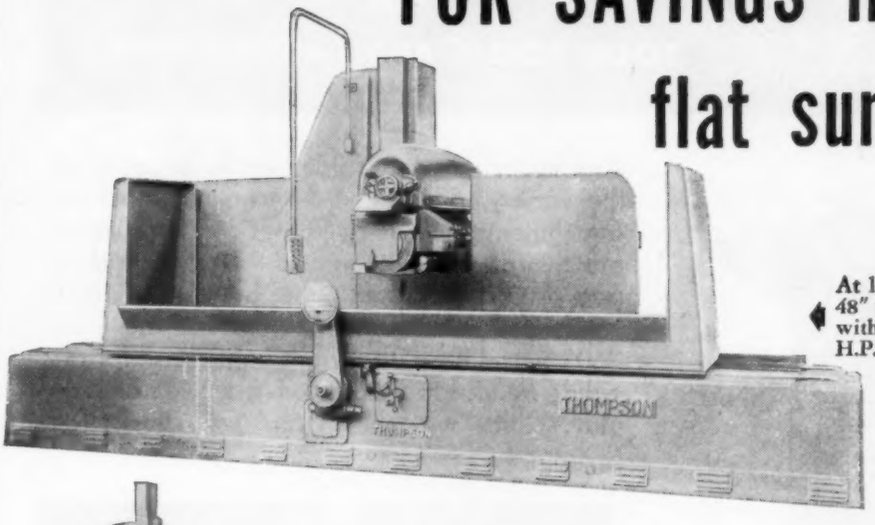
Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

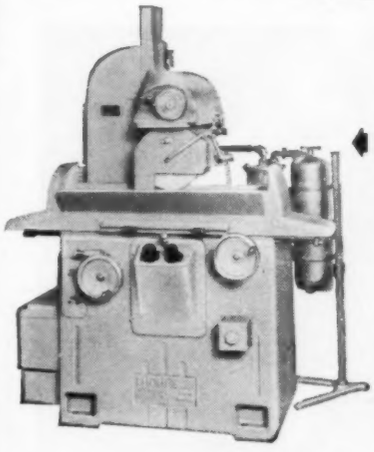
THE DYKEM COMPANY, 2301 B North 11 St., St. Louis, Mo.
In Canada: 2408 Dundas St. West, Toronto, Ont.

INVESTIGATE

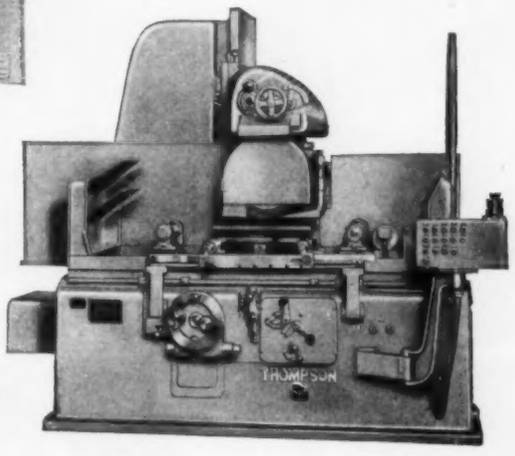
the complete line of Thompson Machines FOR SAVINGS in grinding every flat surface or contour



At left—Thompson Heavy Duty Type CX 36" x 48" x 120" Hydraulic Surface Grinder. Equipped with super precision spindle powered with 40 H.P. motor.

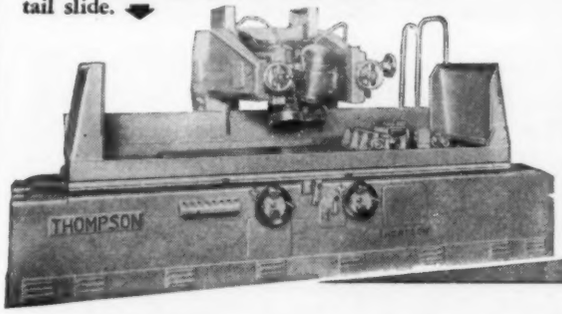


At left—Thompson Type "F" 6" x 10" x 18" Hydraulic Surface Grinder. This machine is arranged to utilize a new principle of applying coolant to the grinding wheel. All of the coolant is applied through the grinding wheel making it possible to grind exceedingly thin sections without burning or warping the work.

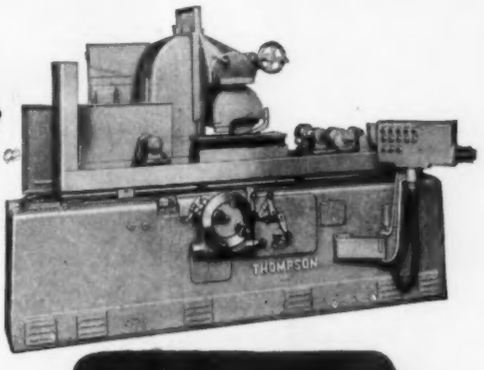


At right—Thompson Type "C" 16" x 16" x 36" Truforming Grinder. The latest design of a Truforming (Crushed Wheel Grinding) machine arranged with Thread Roll Die Grinding Fixture equipped with 20" dia. x 6" face wheel driven by 30 H.P. motor.

Below—Thompson 12" x 11" x 48" Dovetail Way Grinder, designed to eliminate the expensive job of hand scraping machine tool dovetail way bearings. The machine illustrated has capacity for a 12" wide by 48" long male or female dovetail slide.



At right—Thompson Type "B" 12" x 11" x 36" Truforming Grinder. A new design of a popular Truforming (Crushed Wheel Grinding) machine arranged for production grinding of intricate contours.



SEE OUR NEW 32-PAGE CATALOG IN SWEET'S OR WRITE US FOR COPY

Thompson SURFACE Grinders

The Thompson Grinder Co., Springfield, Ohio

Copyright 1948—The Thompson Grinder Co.

Address Dept. 10

HARDINGE
ELMIRA, N.Y.

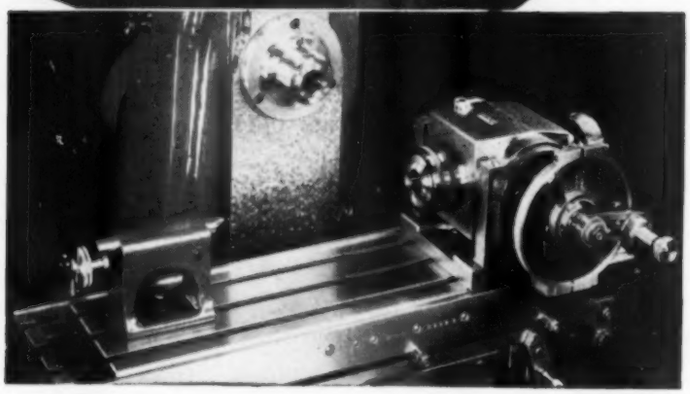
HIGH SPEED PRECISION MILLING MACHINE

FOR

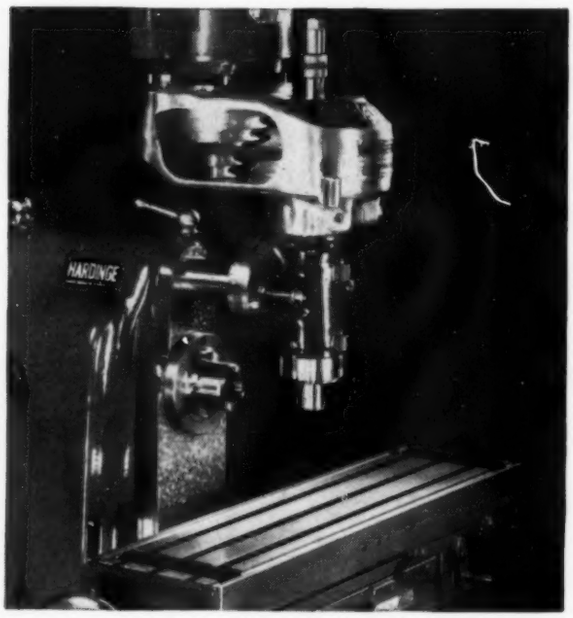
TOOL ROOM AND LABORATORY

Tool room and laboratory work, because of the variety, demands useful milling machine attachments. Hardinge knows this. Illustrated are two attachments in addition to the arbor and vise shown below. Other attachments are: Power feed for table; oil coolant facilities; 360° swivel base, also right angle base for dividing head; taper hole collets, as well as regular collets; step chucks and jaw chucks for dividing head.

Write for Bulletin TM-UM



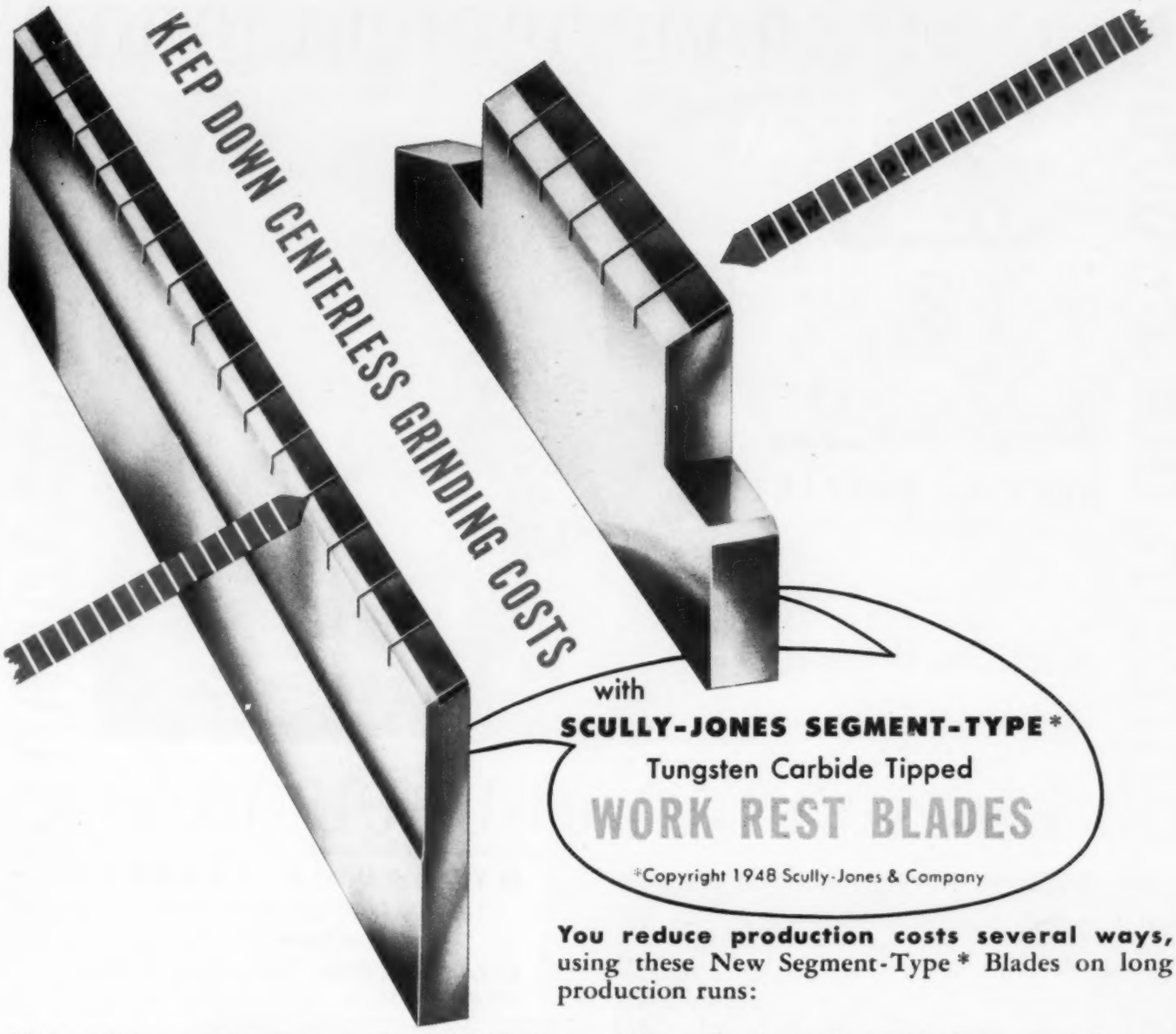
Modern design universal plain dividing head and tailstock. Designed to match the precision qualities of the machine. Features are: Preloaded ball bearing spindle; takes standard 1" capacity collets same as used in horizontal spindle; and high speed indexing, 4 to 1 ratio.



This attachment provides high speed vertical milling. Has separate motor driven preloaded ball bearing spindle — eight selective speeds from 465 to 4250 r.p.m.—takes standard ½" capacity collets. Vertical head swivels to angular settings.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



You reduce production costs several ways, using these New Segment-Type * Blades on long production runs:

• **You reduce maintenance costs of the blade,** because the short segments resist warping during the brazing process. This avoids any strains in the carbide which may occur when brazing long strips, and which often result in quick failure of the blade.

• **You have less down time,** because the harder grade of carbide, used for tipping, gives longer wear and requires only occasional regrinding.

• **You produce more pieces "to specifications,"** because the blade will maintain its alignment while in service.

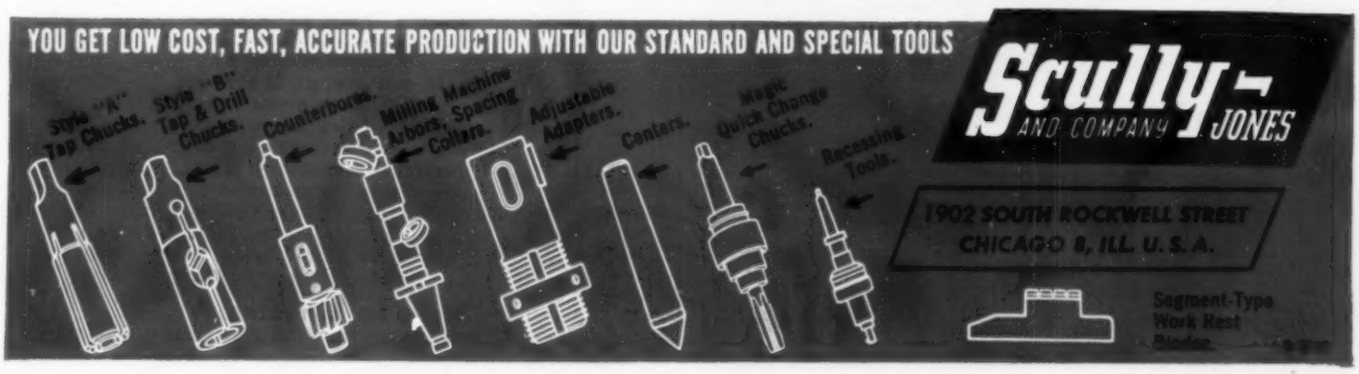
• **You will not mar the work being ground,** because the slots between the segments, permit the coolant to wash away any chips and keep temperature of blade at proper efficiency point.

• **You save money in reconditioning a blade,** because you need only replace damaged segments, not the whole strip.

IMMEDIATE DELIVERY

of popular sizes, from stock

Write for folder showing complete specifications and prices on this new type of Work Rest Blade.


YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS
Style "A" Tap Chucks.
Style "B" Tap & Drill Chucks.
Counterbores.
Milling Machine Arbors, Spacing Collars.
Adjustable Adapters.
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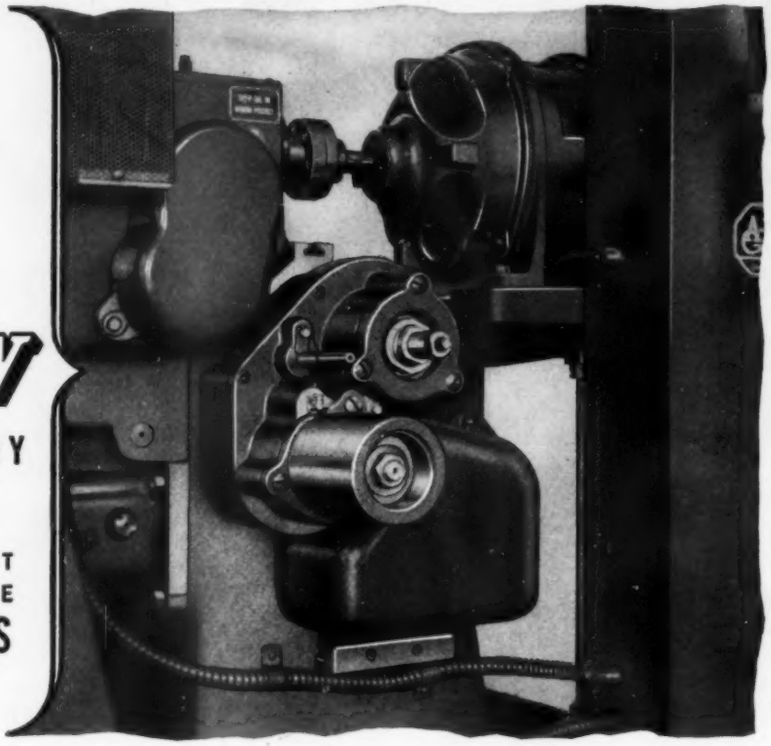
Magic Quick Change Chucks.
Recessing Tools.
Scully-Jones AND COMPANY
1902 SOUTH ROCKWELL STREET
CHICAGO 8, ILL. U. S. A.
Segment-Type Work Rest Blades

Goss & DeLeeuw

MACHINE COMPANY
KENSINGTON, CONN.

★

THE WORLD'S FINEST
MULTIPLE SPINDLE
CHUCKING MACHINES



ECONOMY
THE W&B Co

ECONOMY Lubricant 1888
fluid type - water soluble
For Grinding and Cutting

Rapid stock removal—
fast chip settling—non-irritating
to nose, throat or skin

THE WHITE & BAGLEY COMPANY
WORCESTER, MASS. • DETROIT, MICH.
Originators of Grinding Lubricants

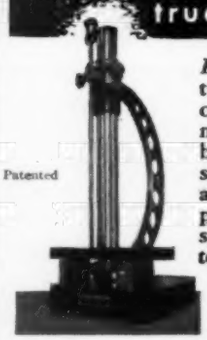
HYDRAULIC PRESSES
30 to 1,000 Ton—Built to Order
Write for illustrated catalog
M & N MACHINE TOOL WORKS, INC.
152 ORONO ST. CLIFTON, N. J.

BAUMBACH *The* DIE SET AUTHORITY

All Baumbach Die Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

E. A. BAUMBACH MFG. CO., 1804 S. Kilbourn Ave., Chicago 23, Ill.

Any MICROMETER 1" to 18" size
trued and lapped square



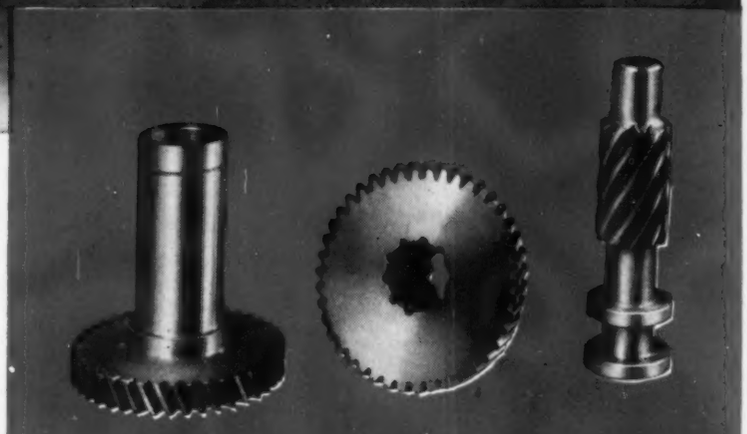
Pearson Precision "Micrometer Lapping Fixture" gives your plant constant *exact check* on all micrometers. Any good toolroom man can operate it expertly. No disassembling of micrometer other than removing spindle. Laps micrometer in exact right angle with center line of spindle; and in perfect alignment with end of micrometer spindle. Also makes an excellent comparator. Saving an hour's rejects may more than pay for this fixture. "This fixture will also accurately lap adjusting snap gauges with addition of a new holding bracket."

Write for Literature
MANUFACTURED BY RED WING MOTOR CO., RED WING, MINN.

Check Your Procedure

In The Red Ring Gear Laboratory

Before You Start Gear Production

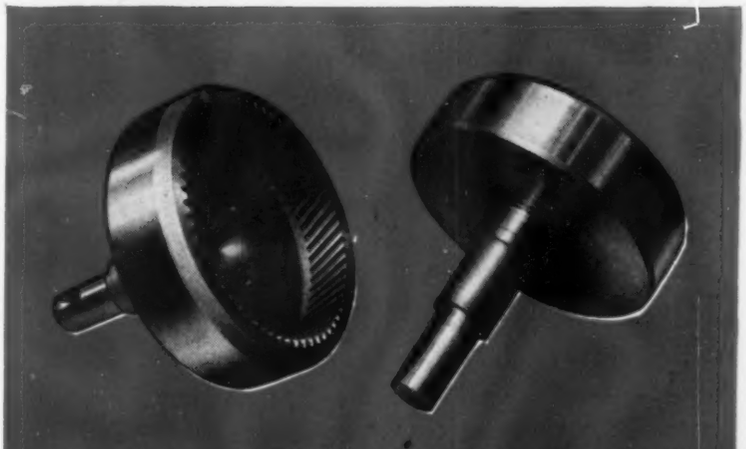


Gear used in radar equipment having 42 teeth, 26.4810 N.D.P., 18°-15'-22" N.P.A. and a right hand helix angle of 25°. Also external and internal splines having 10 teeth, 20 N.D.P., 30° N.P.A. and 31°-34'-26" helix angle. Units had to assemble on a nonselective basis.

THE Red Ring Gear Laboratory has been organized for your convenience and assistance. You may have a pilot job you want produced or a limited number of special gears, perhaps gears having very close tolerances which you need for experimental or research work. You may have questions involving gear design, the choice of gear materials, methods of processing, heat treatment, or gear finishing.

The Red Ring Gear Laboratory, with its staff of gear specialists and full complement of gear processing machinery, can help you solve these problems and turn out gears for you in limited quantities—any type of spur or helical gear and to any degree of precision.

Red Ring Gear Engineers will be very glad to discuss with you any problem in this field. The gear laboratory is not set up for production runs of any type of gears.



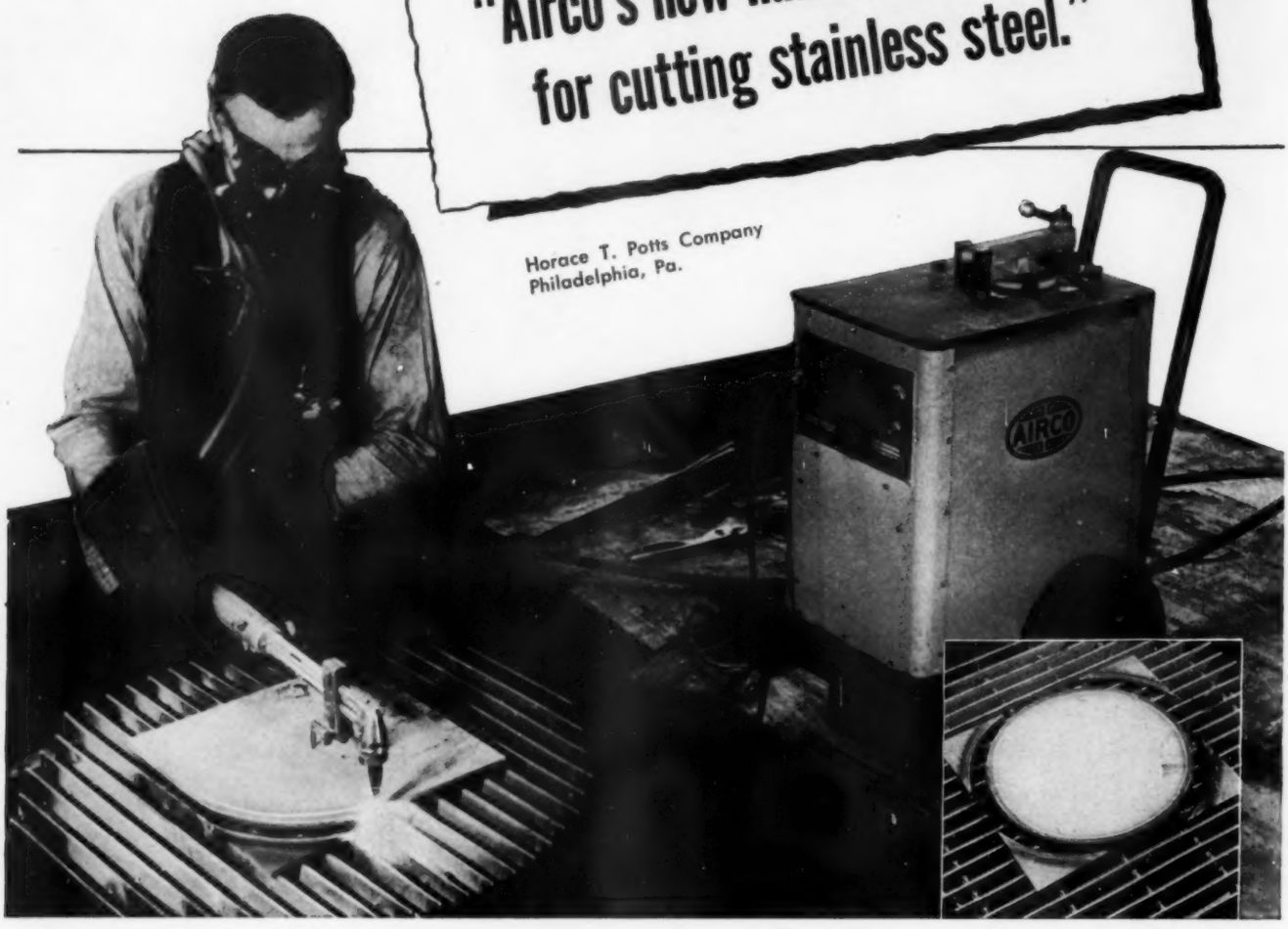
Marine reduction gear having 61 teeth, 7 N.D.P., 18° 17' N.P.A. and a 24°-45'-43" helix angle.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

"Airco's new hand torch is tops for cutting stainless steel."



Horace T. Potts Company
Philadelphia, Pa.

In full, the Horace T. Potts Company stated: "For years we have wanted a hand torch for occasional cutting of irregular or circular shapes from stainless plate – equipment that would permit us to flame cut stainless instead of the costly sawing and machining work. Also, we must have a cut edge that can be rewelded without grinding or machining. For this type of work we feel the new Airco torch is especially adaptable. Of course, for production work we will continue to rely on our Airco machine gas cutting equipment."

This new torch operates on the Flux-Injection principle and utilizes the same portable feeder unit used for machine gas cutting of stainless steel. The torch itself is equipped with a new remote control cut-off that permits automatic, non-clogging flux flow.

Designed in both 21" and 36" lengths, the torch is durable and sturdy, featuring a 90° monel head . . . stainless steel tubes . . . stainless steel lever and ribbed handle. And, *especially important*, the new torch uses standard Airco cutting tips – no special tips or attachments to buy!

If you would like to have this torch demonstrated right in your shop . . . or if you desire more information, write for Bulletin ADC-652. In either case, address: Dept. AM-8465, Air Reduction, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Co., Houston 1, Texas. On West Coast: Air Reduction Pacific Company, San Francisco 4, Calif.

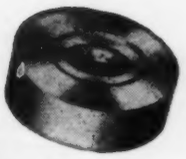
AIRCO **AIR REDUCTION**

Offices in All Principal Cities

Headquarters for Oxygen, Acetylene and Other Gases . . . Carbide . . . Gas Welding and Cutting Machines, Apparatus and Supplies . . . Arc Welders, Electrodes and Accessories

Talide (TUNGSTEN CARBIDE) Drawing Dies

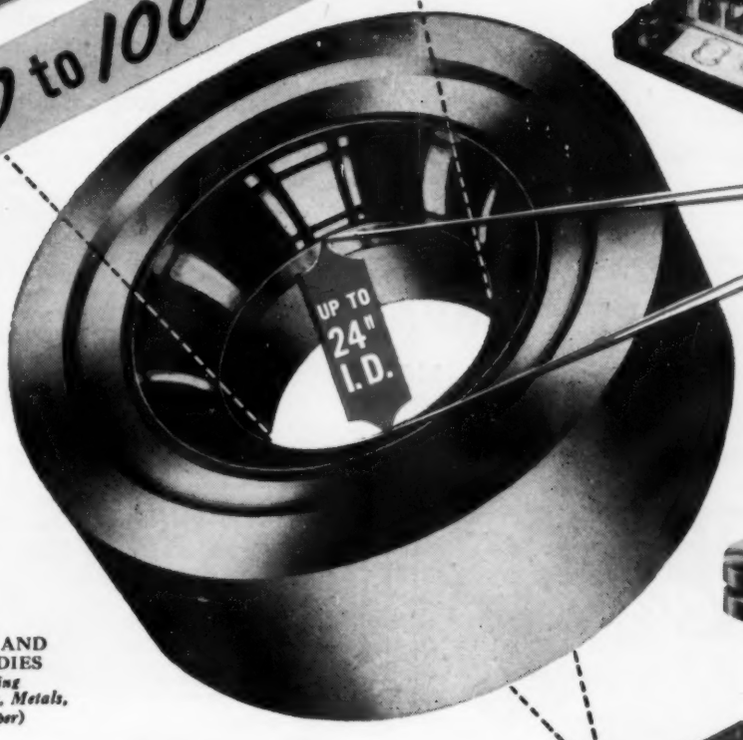
20 to 100 Times the Life of Steel Dies

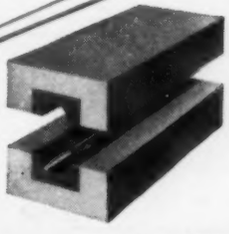


DRAWING DIES
(For Wire, Tubing and Bar Stock)

SPINNING AND CURLING ROLLERS

PIERCING AND LAMINATION DIES





SWAGING DIES
(For Forming Solid and Tubular Shapes)

POWDER METALLURGY DIES *(For Compacting Powdered Metals and Materials)*

BLANKING AND FORMING DIES
(For Stamping Lamination Discs, Metals, Plastics, Paper)

Isn't low unit cost your ultimate objective? You get more speed and output on long production runs and at lower maintenance cost with the superior quality of Talide Dies. Talide Dies out-perform and out-wear steel dies 20 to 100 times. Talide (the hardest metal made) saves up to 50 hours polishing and redressing time on a single die. And, since Talide Metal takes and imparts the smoothest finish possible, surface defects are practically eliminated. Purchase Talide (tungsten carbide) Dies in any practical shape and of inside diameter up to 24".

Write for Die and Wear Part Catalog 46-WP.

Talide (TUNGSTEN CARBIDE) Performance!

TUBE MANDRELS

HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws, and Collapsible Tubes)

TALIDE METAL MEETS EVERY REQUIREMENT

SINTERED CARBIDES — MC TALIDE — HOT PRESSED CARBIDES

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS — DRAWING DIES — WEAR RESISTANT PARTS

Vitrified

Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels.

Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Silicate, Shellac and Resinoid Bonded Wheels.

VITRIFIED WHEEL COMPANY

WESTFIELD **MASS.**

VITRIFIED

DoALL PORTABLE

Flash Welder

(DBW-5)

FOR . . .
Bandsaw blades up to 2" wide and drill rod up to 5/16" in diameter and similar work.

DOES . . .
Automatic flash welding, annealing, grinding off flash.

ENABLES . . .
anyone to make uniformly strong welded joints. This dependable heavy-duty flash welder has many advantages — jaws cannot touch each other causing transformer burnout; can be adjusted to match saw blades exactly. There are selective annealing heats for various widths and thicknesses. The weld selector and spring-tension controls are calibrated to synchronize gap spacing and pressure, assuring perfect grain structure, density and uniformity of welds. Capacity 8 KVA. Operates on 220-v. single-phase, 50-60 cycle a.c.

Write for Complete Details

The DoALL COMPANY
Band Saws • Machine Tools • Gage Blocks
Des Plaines, Illinois

LUERS Patented Cutting Off Tool Holders
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY

Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents Inc.

Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
- ALL AROUND DEPENDABILITY

Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

H&G DIE HEAD

See our Advt. on Page 325 Mar. 11,'48 American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
Los Angeles: *A. C. Behringer, 324 N. San Pedro St., San Francisco; Guy Reynolds, 464 Vernon St., Oakland.* Canada: *F. Barber Machinery Co., Toronto, Canada.*

CONCENTRICITY
of head, body and thread is assured in every Ottemiller Screw Machine Product because they're "Milled from the bar."

CAP SCREWS
SET SCREWS
MILLED STUDS
COUPLING BOLTS

PRECISION MILLED by WILLIAM H. Ottemiller CO.
York, Pennsylvania
DISTRIBUTORS IN PRINCIPAL CITIES

A Report to Industry—

On the most difficult - most important job we've ever done

These parts are the main components of a turbo-jet engine. Millions of man hours — millions of dollars and the complete cooperation of American Enterprise has gone into their manufacture. Our part in the job was the design of machines, fixtures and broaches to do the major part of the metal removing. In the days ahead hundreds of plants will be affected by this program. So that you may know some of the facts about turbo-jet tooling we highlight some points from our progress report:—

1. *A Turbo-jet engine* is composed of three major sections — compression, combustion and turbine.
2. *Most metal removing* is in the compression and turbine sections.
3. *Blades, Buckets, Vanes, Rotors and Stators* are major components of these sections.
4. *Compressor rotors and turbine discs* are usually very tough metal and have about 60 to 90 blade slots.
5. *Compressor blades* vary in formula and have two major root shapes. Ball root and dovetail are the most common shapes.
6. *Buckets* are usually pine tree in root form and are a major tooling effort.
7. *Lapointe Machines* are available for all Turbo-Jet Broaching.
8. *Most tooling problems* have been worked out. Don't be afraid to enter this program.
9. *Contact Lapointe* for latest information before entering your bids.

HUDSON LAPOINTE MASS.

THE Lapointe MACHINE TOOL COMPANY

"Tooling for Jet Propulsion", a full color, 16 mm. sound film on Broaching is made available to Engineering and Mechanical groups. Write Dept. 71.

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—in Stock or Made to Order—

FOR EVERY INDUSTRIAL NEED

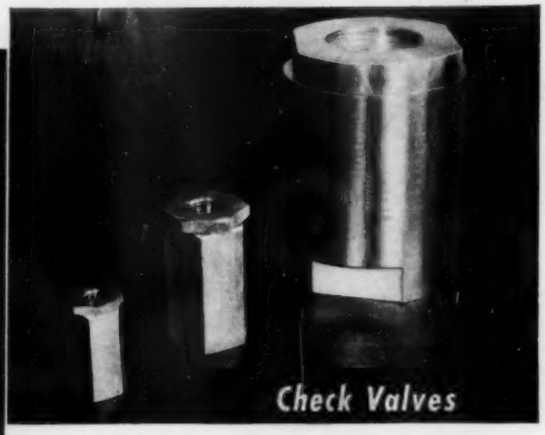
Pictured here are but a few of the many hydraulic devices produced by Electrol for industry . . . transportation . . . and agriculture. We will gladly supply further details as to the application of these units in the machines you use or the products you make. Or—better still—have our engineers work with you in adapting them to any specific design.

Speed Control Valves

Allow flow in one direction and, by use of a metering device, accurately control reverse flow from 0 to valve max.—even after thousands of cycles. Flow controlled by screw-actuated metering pin. Handle air or oil, with pres sures up to 1,500 p. s. i. Standard sizes: ⅛, ¼, ⅜, ½ and ¾" N. P. T.

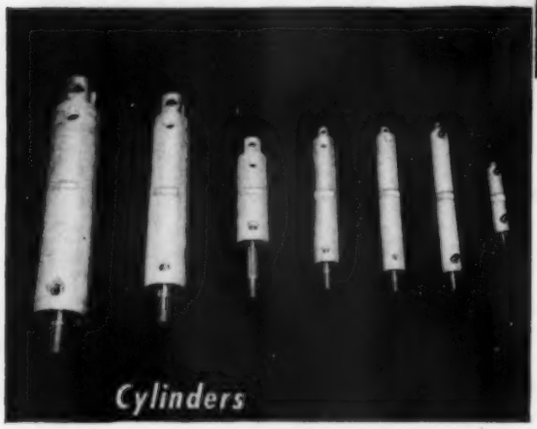
Hand Pumps

Uniform two-way ac tion for maximum operating efficiency. Low in cost, economi cal in operation. Few moving parts, mini mum of maintenance. Operating pressure: 0 to 1,500 p. s. i. Pump delivery: 1.5 cubic inches per cy cle. ⅜" N. P. T. ports. Suction and pressure check valves built in.



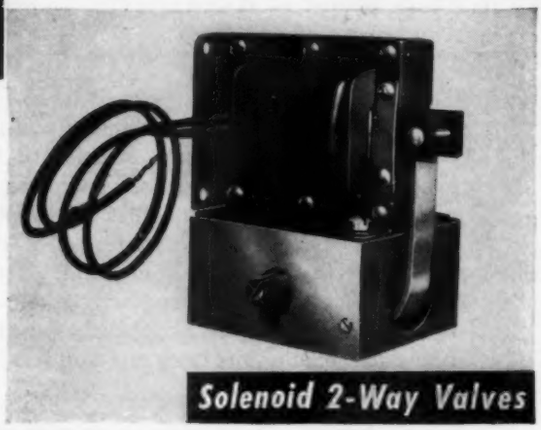
Check Valves

Provide positive sealing from low to high pressures—5,000 p. s. i. max. Used for air, gas, water and oil control with min. pressure drop and positive sealing against re turn flow. Standard models feature bronze and brass ele ments. Standard sizes: ⅛ to 2" N. P. T.



Cylinders

"500-1 Series" hydraulic cylin ders available in bore diameters ranging from ¾" up to and in cluding 3". Chromium plated pis ton rods, honed seamless steel tubing cylinders. Conventional "O" ring packings. Clevis mount ing and standard pipe ports. Can be used in air or oil. Pressures up to 1,500 p. s. i.



Solenoid 2-Way Valves

Continuous duty, 110-volt, 60-cycle AC Solenoid 2-Way Valves with operating pressures from 0 to 3,000 p. s. i. Port sizes: ⅛, ¼, ⅜ and ½" N. P. T. Supplied either normally open or closed. Balanced type poppet and seat assures posi tive operation with no internal or external leakage. Other 2-Way Valves available with 12 and 24-volt DC Solenoids.

Electrol

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KINGSTON, NEW YORK

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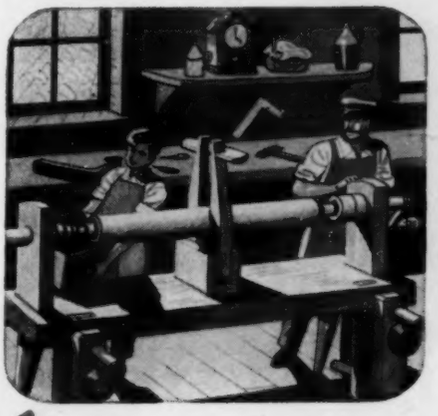
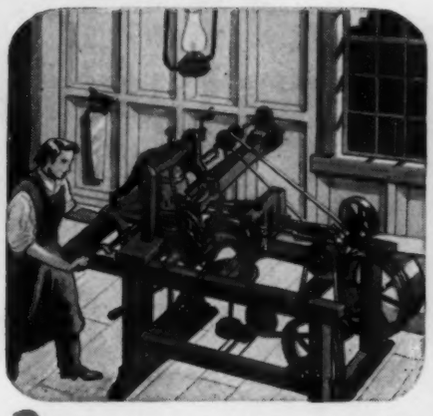


1 **1827**—Early machine tools were a result of shop owner and mechanic tinkering around, trying to step up output. They were hand built, crude, and no two machines were alike, since measurements were not yet standardized.



2 **1855**—Gradually, methods and techniques became more uniform, more exacting. Machine tools developed for one industry were tried successfully in others. But the *real* power behind machine tools, low-cost electricity, was still to come.

3 **1915**—Howell "Red Band" Electric Motors appeared. Applied to lathes, grinders, cutters, shapers and other machine tools, these rugged, industrial-type motors soon won wide acclaim for making good on hard jobs.

THEN, AMERICA TOOLED-UP!

4 **Today**—Machine tools, operated by skilled workers, help put more goods in the hands of more people, at less cost!

America is really tooled-up! And Howell Motors have helped. In thousands of shops, they are recognized as tops for the tough jobs.

These dependable precision-built motors are also an important source of power for pumps, fans, conveyors and other vital industrial equipment.

Are *you* using Howell Motors?

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.

Here's another precision-built Howell Motor . . . industrial type with copper or bronze bar rotors . . . specially insulated . . . statically and dynamically balanced.

Howell Protected Type Motor

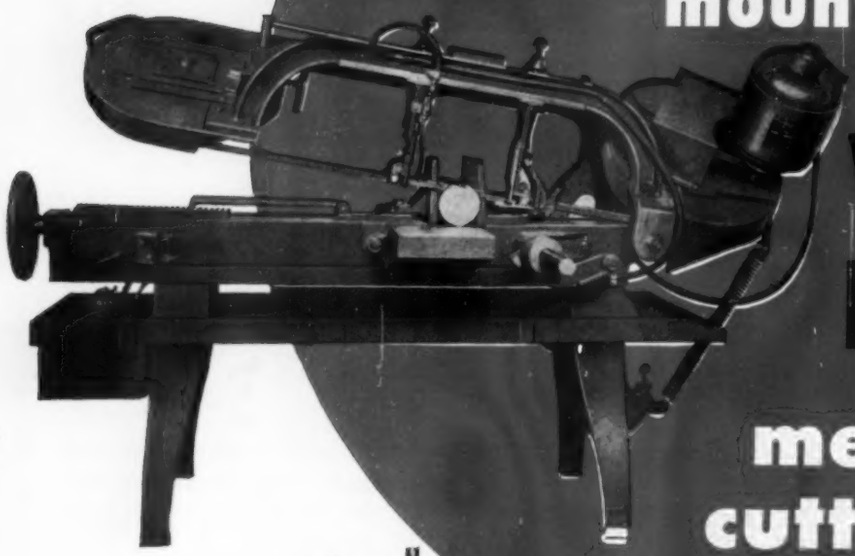
HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Manufacturers of Quality Industrial Type Motors Since 1915

Here's a tool

that will help you lick mounting costs!



THE WELLS No. 8 metal cutting band saw

THE WELLS No. 12

A production tool featuring automatic cutting cycle and controlled blade pressure. Capacity: 12" x 16" rectangular, 12¼" O.D. rounds.

With the Wells No. 8 you save three ways—time . . . labor . . . material. You save time because band sawing is *continuous* sawing. You save labor because the saw is so easy to use—anyone can operate it—virtually without attention. You save material—more pieces per length of stock—because the blade removes a minimum of material at each cut. Get full details from your Wells dealer or write to the factory.

TECHNICAL DATA

CAPACITY:	
Rounds	8" dia.
Rectangular	8" x 16"
With Special Guides	5" x 24"
SPEEDS, Selective:	60, 90, 130 ft. per min.
MOTOR:	½ H.P.
WEIGHT, Approximate:	750 lbs.

Wells SAWS

Wells

Products by Wells are Practical

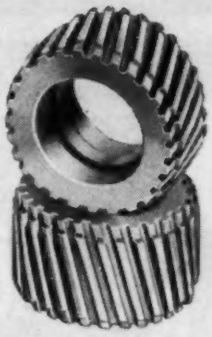
METAL CUTTING BAND SAWS

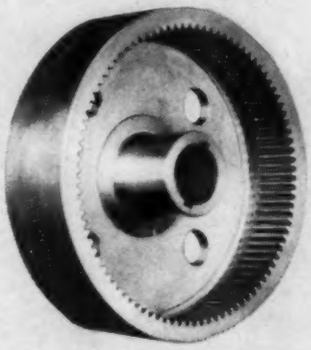
WELLS MANUFACTURING CORPORATION
505 ROOSEVELT RD., THREE RIVERS, MICH.

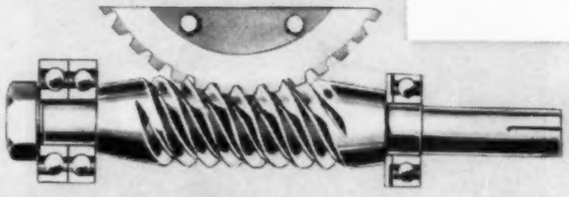
PHILLIE GEAR

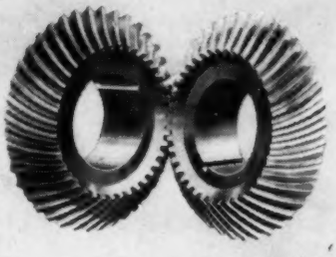
GEARS

WHEN, AS, AND HOW YOU WANT THEM





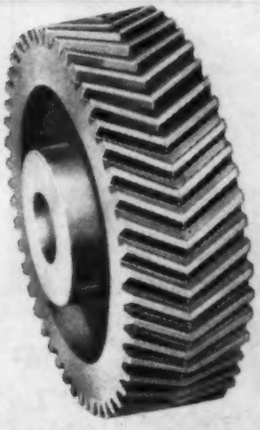


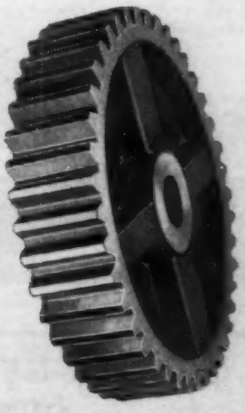


Yes, *one gear* or a *thousand* to meet your most exacting requirements, . . . gears of any type, size and material, — Continuous Tooth Herringbones; Worms and Wheels; Spiral-Bevels; Spurs; "Zerols"; "Hypoids"; Helicals; Mitre; Intermittents; Non-Metallics; Racks; Ratchets and Pawls, etc. — they're all made in our large modern shop, by gear craftsmen.

Send for our latest "*Gear Book*," — and please use your Business Letterhead when writing for it.

"For Over 56 Years, Manufacturers of Gears"





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UP TO 60" PITCH DIA.
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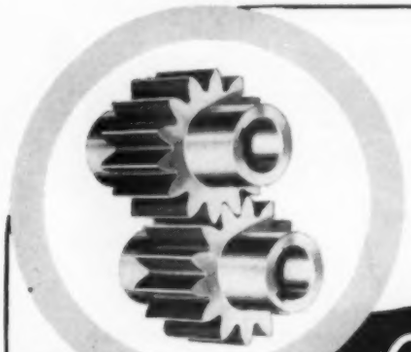

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★ BEVEL
★ HELICAL
★ SPLINE
★ WORM
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GROUND..LAPPED..SHAVED

We of the Cincinnati Gear Company are specialists in the manufacture of gears to meet your specific needs. Our modern plant is equipped with the finest and most accurate equipment for the control and production of Cincinnati *Gears, Good Gears Only.*

To provide the maximum in gear efficiency Cincinnati Gears, where needed, are ground, shaved or lapped. We can shave from 1" to 24" pitch diameter. To eliminate distortion after hardening, high-speed precision gears can be ground to provide the required accuracy.

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"Gears . . . Good Gears Only"
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GEARS
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Any size or shape to utmost accuracy. For quotation on price and delivery Write Dept. G 2

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THE HARTFORD SPECIAL MACHINERY CO.
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MP QUALITY GEARS CUT TO ORDER MP

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the one gear suited for your job.

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PROMPT DELIVERIES
on
Herringbone Gears
(up to 60" dia.)
Cut on new Sykes Generators

You get accuracy . . . long life . . . and prompt deliveries on herringbone and other types of commercial gears.

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Gears FROM 1/4" TO 36" O.D.

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ANY TYPE FROM ANY MATERIAL DESIRED

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The Braun Gear Company has been shaping the wheels of industry for more than 38 years, producing gears of quality at economical prices. The large, thoroughly modern Braun plant is now more than ever equipped to supply the things that count in gears—precision workmanship, fine materials, good design, and prompt service.

Send samples or prints and specifications for immediate quotations. Whether your requirements are for one gear or thousands, you will find that economy begins with Braun!

BRAUN GEAR COMPANY

239 Richmond St., Brooklyn 8, N. Y.

No. 1 *in a series of performance case histories.*

"Grant reducer in operation 17 years . . . has required no maintenance except lubrication!"

. . . reports Massachusetts leather products manufacturer.

"On January 31, 1931 we installed a Grant Worm Gear Reducer in our plant to run two 15′ x 14′ stock chest agitators. Except for lubrication, reducer has required no maintenance in spite of an average of more than 144 hours a week use over the 17-year period."

— and that report is only one of many on file at Grant Gear Works. Yes, the amazing story of Grant Reducer performance is told over and over again by scores of enthusiastic users. So be wise, specify Grant and get extra quality and construction features that add up to long, low-cost service. Write for details about the Grant Reducer best suited for your job.

Grant Gear Works, Inc.,
169 West Second Street
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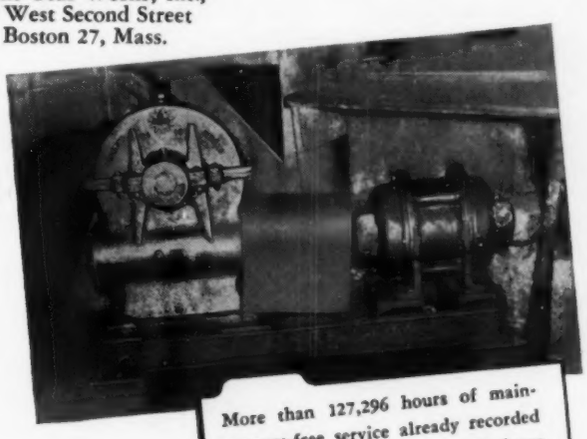
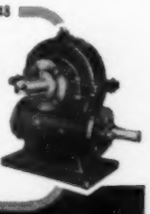


More than 127,296 hours of maintenance-free service already recorded for this Grant Worm Gear Reducer and it's still in perfect condition! With such outstanding performance, it's no wonder users install 'em and forget 'em.

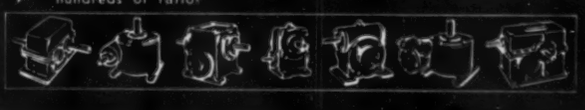
WRITE TODAY FOR FREE CATALOGUE

1877 – GEARED TO INDUSTRY'S NEEDS FOR 71 YEARS – 1948

Grant SPEED REDUCERS



7 gear arrangements — hundreds of ratios



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PITTSBURGH GEAR
TAPER SERRATED SHAFTS and PINIONS

If you're plagued by repeated breakage of shafts and pinions switch to Genuine Pittsburgh TAPER SERRATED SHAFTS and PINIONS. No more old-fashioned, weakening keys and keyways. Full metal strength preserved. Shafts and pinions V-LOCKED all around. Shock-proof. Can't shake loose . . . yet easy to apply or remove.

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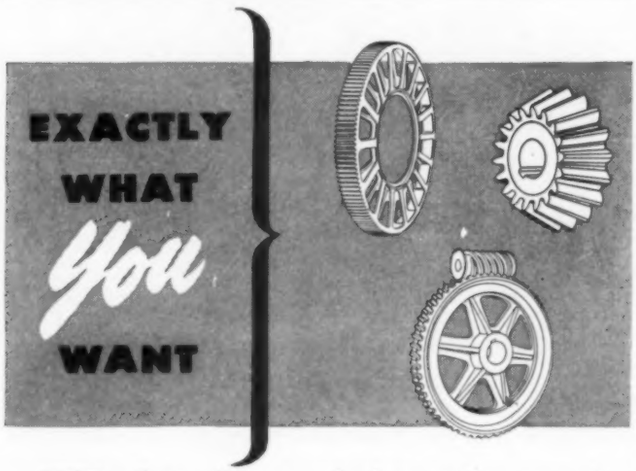
It takes more than big equipment to produce bevel gears as large as this one; it takes skill in handling and constant expert supervision, from start to finish. It takes the technical skill of a Big Gear Specialist—Stahl. For spurs up to 72" P.D. 1 D.P. . . . for bevels to 54" P.D. 1 D.P., spirals and helicals to 38" P.D. 2 D.P., worm gears to 48" P.D. 2 D.P. . . . for rawhide, fabroil or bakelite gears . . . any size . . . for racks up to 20' long 3 D.P.—*get a Stahl estimate first!*

STAHL GEAR & MACHINE CO.
3901 Hamilton Ave., CLEVELAND 14, OHIO



FOR well over 40 years we've been making gears of all types from any practical material in diameters ranging from inches up to 30 feet. We make racks, speed reducers and special machinery, too.

And we are proud of the fact that, in those 40 years, we have given our customers complete satisfaction.

Long ago, we found that it was "good business" to give you exactly the kind of work you want—to take an individual interest in every product that leaves our plant. And we do.

That's why we think it would be "good business" for you to ask Earle for estimates on your work. The Earle Gear and Machine Company, 4723 Stenton Ave., Philadelphia 44, Pa.; Sales Offices: 149 Broadway, New York 6, N. Y.; 901 Davis Ave., Pittsburgh 12, Pa.

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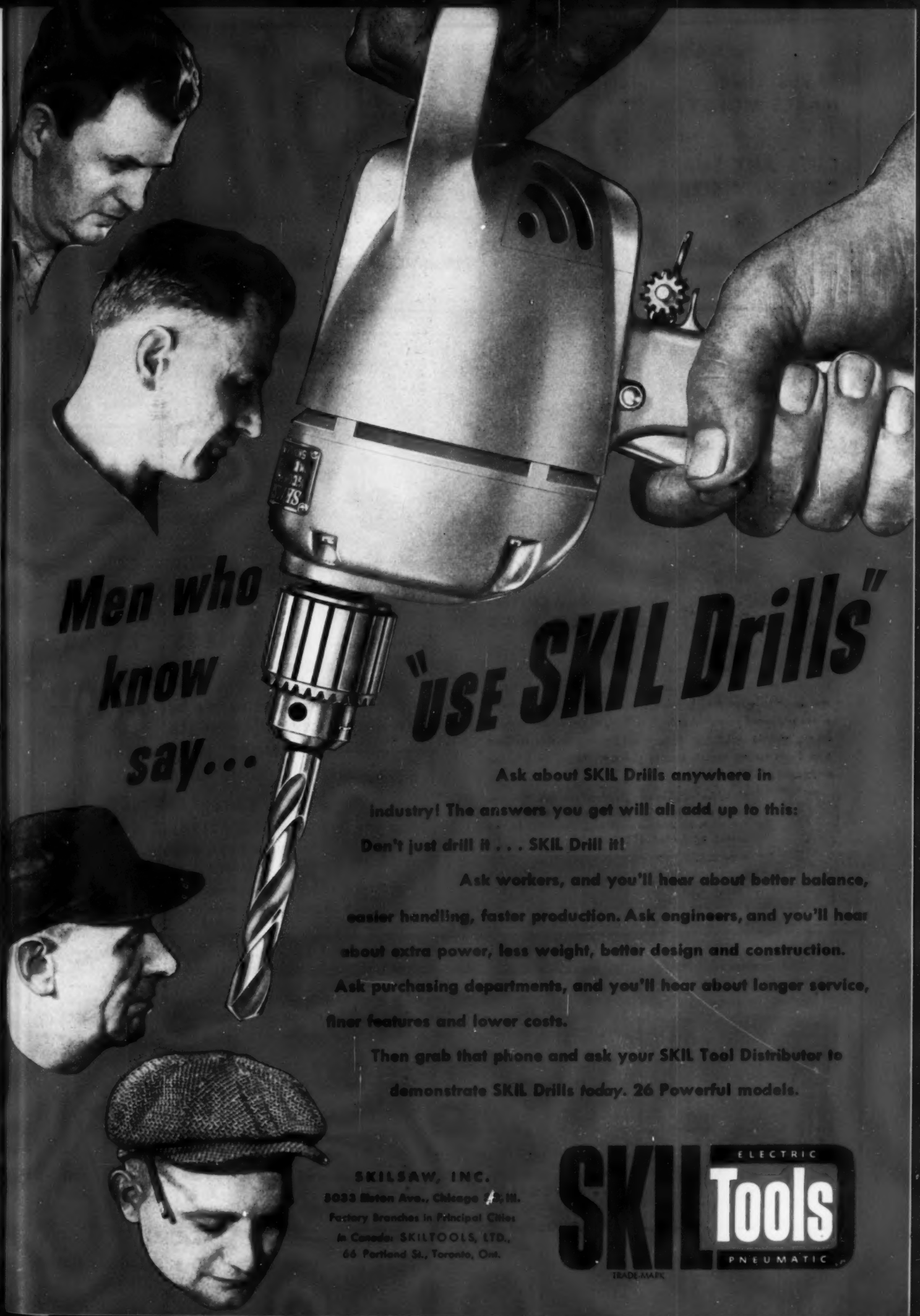

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Ask about SKIL Drills anywhere in industry! The answers you get will all add up to this: Don't just drill it . . . SKIL Drill it!

Ask workers, and you'll hear about better balance, easier handling, faster production. Ask engineers, and you'll hear about extra power, less weight, better design and construction. Ask purchasing departments, and you'll hear about longer service, finer features and lower costs.

Then grab that phone and ask your SKIL Tool Distributor to demonstrate SKIL Drills today. 26 Powerful models.

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SAVES TIME
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CUTS ANY SHAPE
CUTS ANY SIZE
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CAPACITY UP TO
1/4" STOCK

MARSHALLTOWN
THROATLESS SHEARS

Here's the shear that offers best performance features. Cutting speed 6' per minute. High grade tool steel cutters. Write today for details. Prompt shipment.

MARSHALLTOWN MANUFACTURING COMPANY
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WHEN YOUR H.S.S. TOOLS AND FORM CUTTERS ARE HARDENED THE SENTRY WAY

Sentry High Speed Steel Hardening Furnaces employing Sentry Diamond Blocks give full hardness to molybdenum, tungsten and cobalt high speed steel cutting tools and high resistance to wear and breakage because the neutral atmosphere produced permits thorough soaking at hardening temperatures without danger of surface oxidization or decarburization. Form cutters remain true to size and shape, no grinding necessary after hardening.

Sentry Furnaces are fast, clean and economical. Anyone can operate them. Ideal for tool room or production line. Write for information or send samples to be heat treated. Ask for bulletin 1054-F9.

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Our service on small gears, due to new equipment recently installed, will interest you.
Send samples or blueprints for quotation

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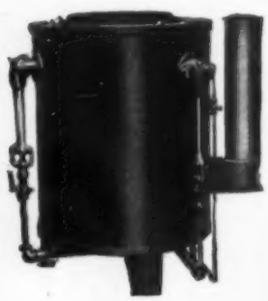
Atmospheric Pot Hardening Furnace



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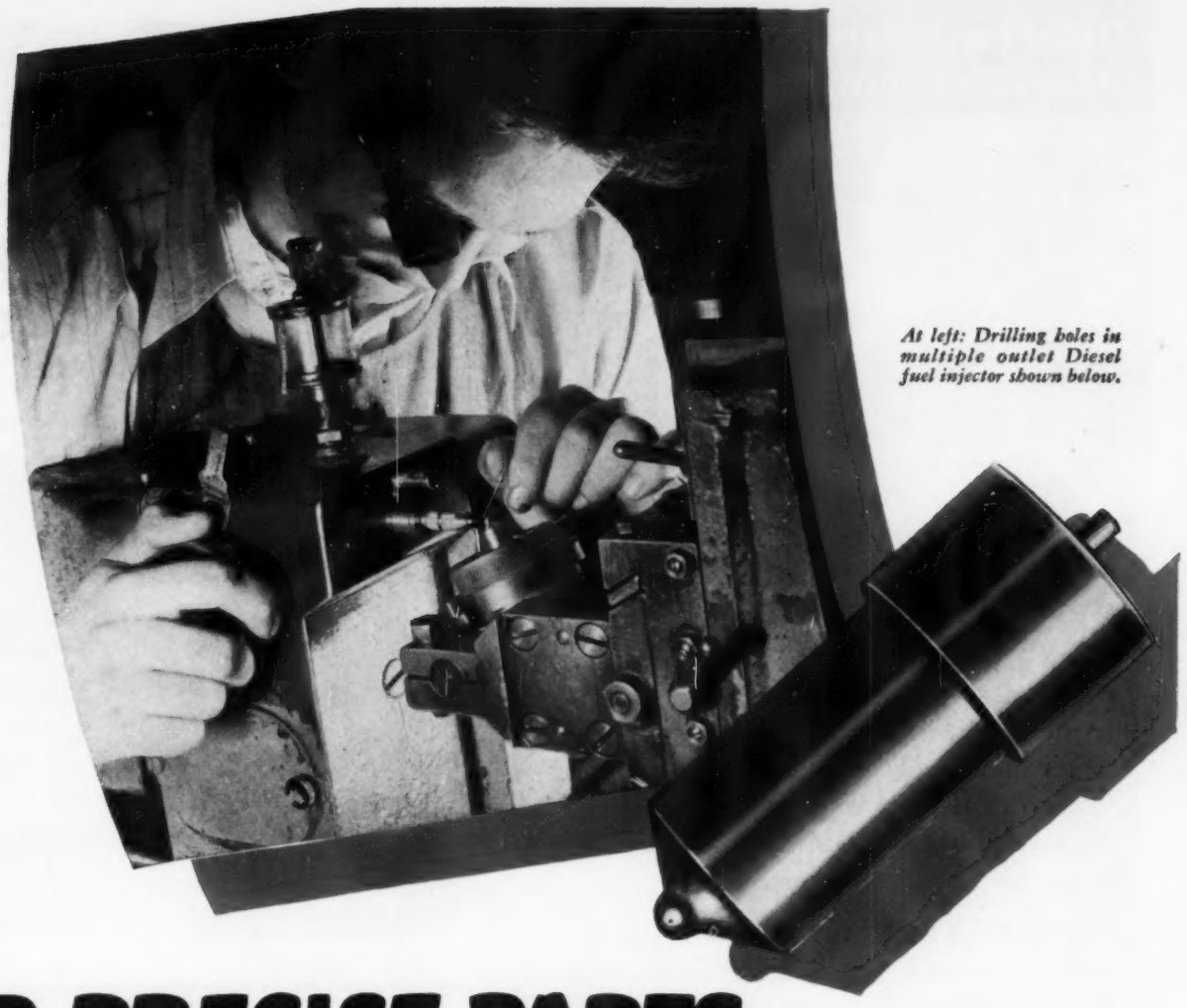
. . . are the efficient, economical answer to today's Heat Treating Problems. *NO BLOWER or OTHER AUXILIARY POWER are needed . . . just connect to your gas supply.*

- The Full Muffle Furnace attains a temperature of 2400° F., and The Pot Hardening Furnace, tangentially fired to assure even heat up 1650° F., are two of many models available.
- Send for the new "BUZZER" Catalog showing full line of Industrial Gas Furnaces, Burners and other equipment.

CHARLES A. HONES, INC.
121 So. Grand Ave. Baldwin, L. I., N. Y.

Full Muffle Furnace



At left: Drilling holes in multiple outlet Diesel fuel injector shown below.

FOR PRECISE PARTS...

on a production basis

use Republic COLD DRAWN ALLOY STEEL BARS

Feeding fuel in tenths of a drop directly into Diesel combustion chambers is a job for hard, tough, durable parts made of Republic Alloy Steels. Furthermore, multiple outlet fuel injectors require drilled holes as small as .002" radius, with lapped and mated valves fitted to .0001".

That's why these precise, tough parts are machined from Republic Cold Drawn Alloy Steel Bars. They provide the UNIFORM MACHINABILITY, accuracy of section, close tolerances and fine surface finish of Union Cold Drawn Products—qualities which make possible hitting that kind of precision on a production basis.

Republic Cold Drawn Alloy Steel Bars are available in all popular analyses, in standard shapes and sizes, furnace treated as you desire—annealed, normalized, spheroidized, stress relieved or *carbon corrected.* And Republic metallurgists are ready to help you get best results—in service and in fabrication. Write today for more information.

REPUBLIC STEEL CORPORATION

Alloy Steel Division • Massillon, Ohio

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Department: Chrysler Building, New York 17, New York

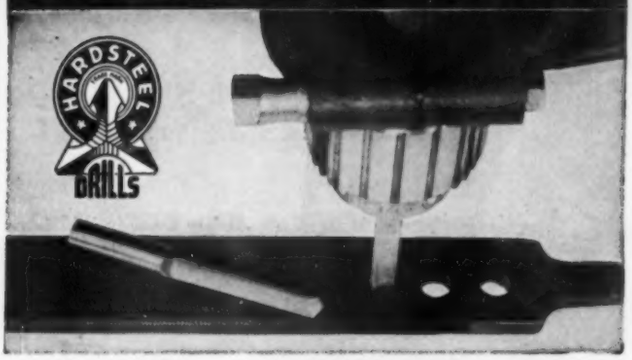
Republic COLD DRAWN

REPUBLIC STEEL

ALLOY STEEL BARS

Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Plates, Pipe, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

Drill Hardened Steels *without Annealing* with "HARDSTEEL"



Don't let anyone tell you that hardened steels must be annealed before drilling, countersinking, counterboring or reaming.

With "HARDSTEEL" drills you can produce accurate, smooth holes in steels hardened by any process — oil-hardened, water hardened, cyanided, nitrided, and they work equally well on work-hardening steels, and high carbon-high chrome steels of any degree of hardness.

"HARDSTEEL" drills used with standard drill presses cut costs in production shops because parts drilled after hardening always match at assembly. In service shops they save time and material and permit engineering changes calling for additional drilling to be made after parts are full hardened.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are now functioning in thousands of plants in parts recovery operations.

You Harden It — We'll Drill It — with "HARDSTEEL"

"HARDSTEEL" Tool bits make faster, deeper cuts on steels and non-ferrous alloys.

BLACK DRILL CO.
Division Black Industries
1388 East 222nd Street
CLEVELAND 17, OHIO

"HARDSTEEL"
DRILLS • TOOL BITS • SPECIALS

HOW TO BUILD THE PUMP INTO YOUR MACHINERY

Tuthill offers this helpful guide to manufacturers who want to save space, material, labor and money by building the pump directly into the design of their equipment. This bulletin describes two types of Tuthill Stripped Pumps designed for this service: Type S, without mounting bracket; and Type SA, with pumping elements only. Capacities up to 50 g.p.m. Ideal for coolant, lubrication, hydraulic and liquid transfer service. Write for Tuthill Stripped Pump bulletin.

TUTHILL PUMP COMPANY
939 East 95th Street, Chicago 19, Illinois

FIGURE THE TIME YOU SAVE *with Nicholson EXPANDING MANDRELS*

Time studies show that, with these widely used precision tools, operations can frequently be completed in less time than was formerly consumed in locating or turning a solid arbor. Sold singly or in sets; for bores ½" to 7". Bulletin 1043.

W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.

ALMOND DRILL CHUCKS

Maximum Gripping Power with Extreme Accuracy and Long Life
Write for Catalog
T. R. ALMOND MFG. CO.
Ashburnham, Mass., U.S.A.

What makes you think Your Product is too unwieldy to handle WITH AUTOMATIC ELECTRIC TRUCKS?

JONES & LAUGHLIN new, high speed cold strip mill at the Aliquippa Works, reduces 30,000 pounds of steel into 6 miles of tinplate in 5 minutes when mill is operating at top speed. Automatic Skylift Giants move and lift these immense coils as easily as you drive your automobile!

Skylift GIANTS

MOVE AND LIFT 30,000 POUNDS OF UNWIELDY STEEL COIL

THERE'S AN AUTOMATIC TRUCK TO FIT *YOUR* PRODUCT . . . TO CUT YOUR HANDLING COSTS 'WAY DOWN!

Steel mills no longer are limited in production speed by the size of coils that can be delivered to and discharged from the mill—because Skylift Giants handle all sizes and weights of coils. One operator lifts and moves 30,000 pounds as easily as you shift gears in your car.

No matter what your product—and how cumbersome *you may think it is to handle*—there's an Automatic model to bring your business the same kind of money-saving handling it brought the steel industry.

Automatic Electric Trucks will end gruelling, back-breaking manual handling in your plant. Exclusive *high pressure* hydraulic lift permits moving and tiering in low clearance box cars and trucks. Yet you also can stack your material up to 130 inches high. Burn-out proof Silicone Insulated Motors prevent motor failure due to overheating.

Mail coupon. Let us show you how Automatic miracles of electric power can earn you miracle savings in handling operations.

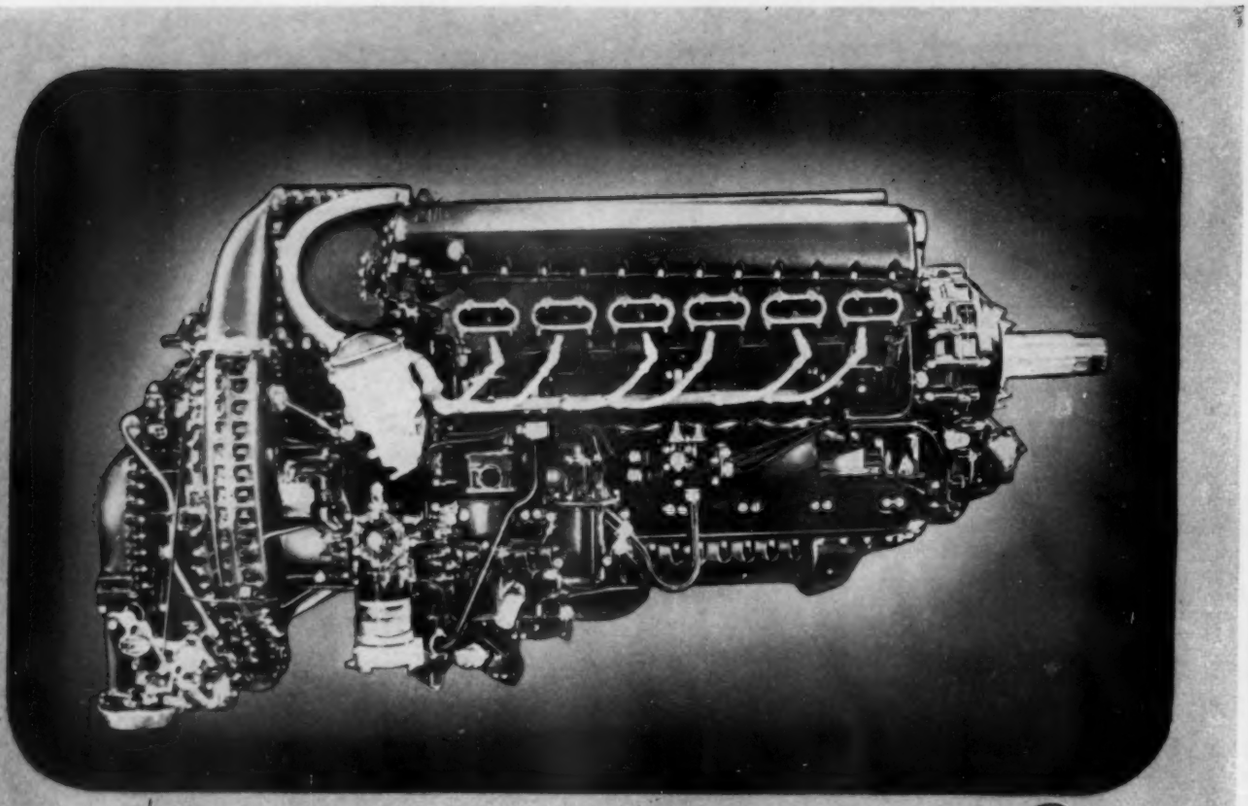
Automatic ELECTRIC TRUCKS
Lighten LIFE'S LOADS

AUTOMATIC TRANSPORTATION COMPANY
DIV. OF THE YALE AND TOWNE MFG. CO.
59 West [illegible], Chicago 20, Illinois

Please mail me, without cost, complete facts on how I can cut my material handling costs with Automatic Electric Trucks.

Company Name.....
By .....Position .....
Street Address .....
City .....Zone .....State .....

MANUFACTURERS OF THE FAMOUS TRANSPORTERS, TRANSTACKERS AND SKYLIFT ELECTRIC TRUCKS



Remember this engine?

Most everyone will recall the outstanding job American craftsmen accomplished in putting the Rolls-Royce Merlin engine on a production basis in this country. We would like to point out that thousands of superb aluminum castings for this famous engine were produced in our Dayton, Ohio plant. Important today, however, is this fact: The same unique combination of Acme services so important on the Rolls-Royce Merlin job continues active today on other important work. Acme can handle your contract if you need (1) engineering service, (2) tools and dies, (3) patterns, (4) non-ferrous castings, or any combination of these four services.

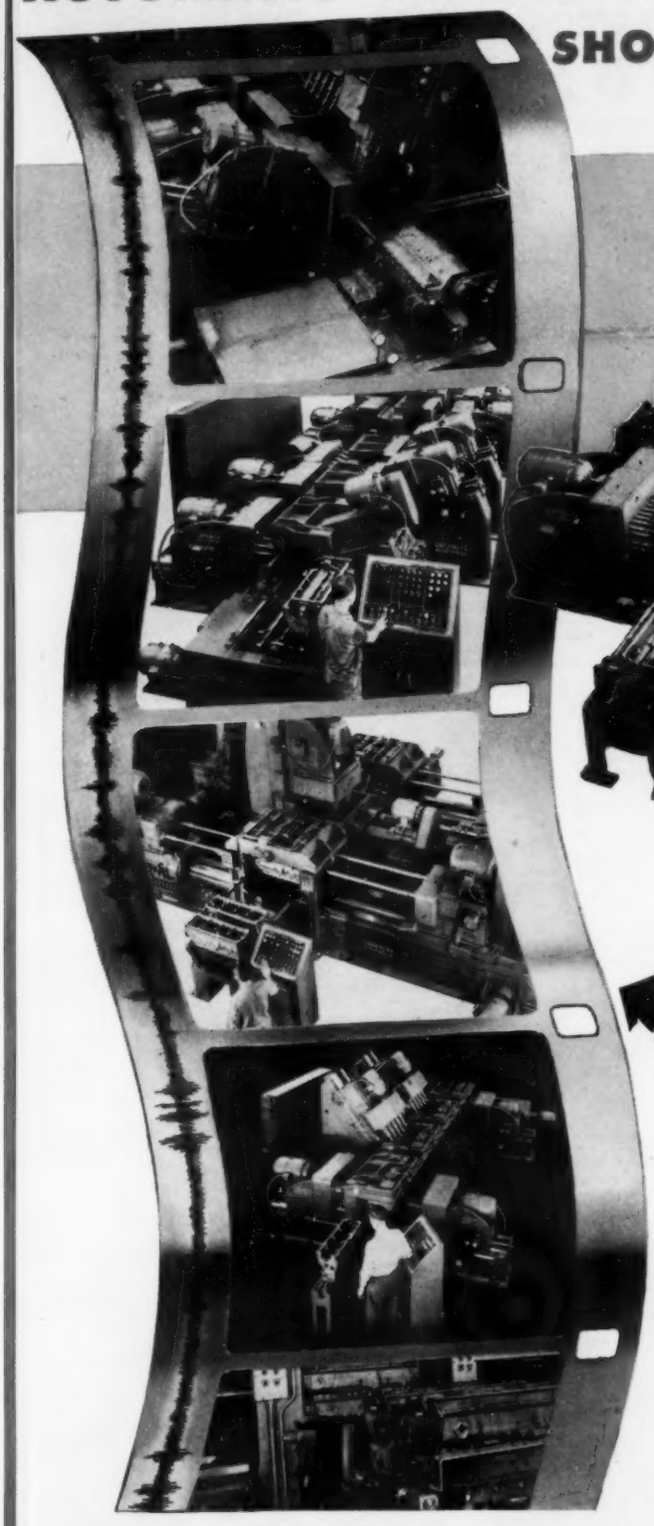
● *Send blueprints for quotations or write for details on Acme facilities.*

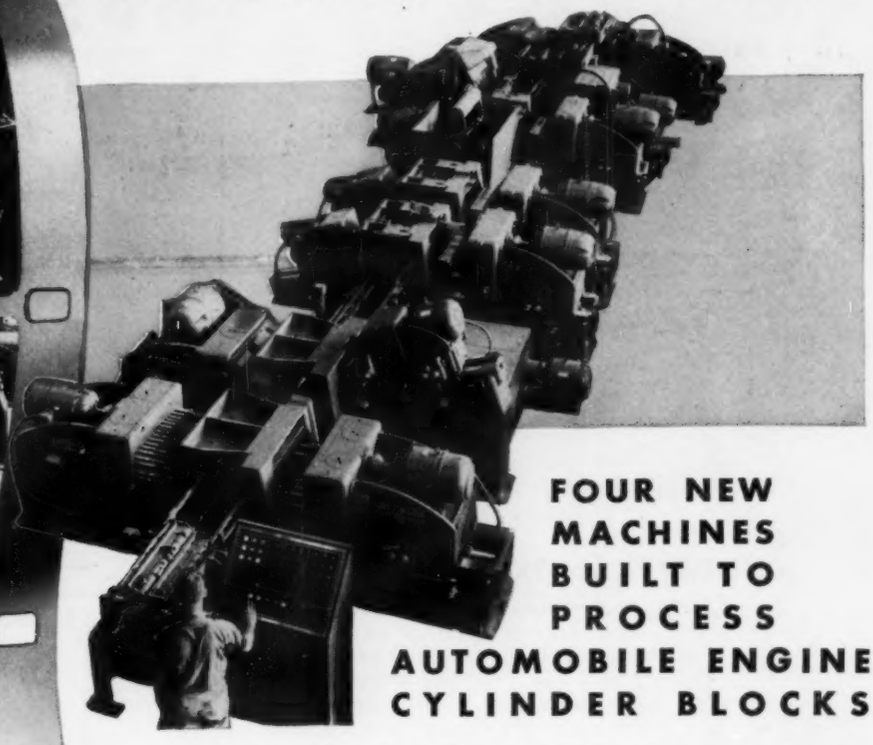
Acme ALUMINUM ALLOYS, INC.

255 NORTH FINDLAY STREET, DAYTON 3, OHIO

GREENLEE

AUTOMATIC TRANSFER PROCESSING MACHINES SHOWN IN NEW SOUND MOVIE





FOUR NEW MACHINES BUILT TO PROCESS AUTOMOBILE ENGINE CYLINDER BLOCKS

A new 16 mm. black and white sound movie features four recent Greenlee Automatic Transfer Processing Machines built to handle all the important machining operations on several sizes of automobile engine cylinder blocks. It shows how the individual heads on the machine work, and how the blocks are transferred, rotated, positioned, clamped, and machined in a continuous automatic cycle.

FOR INTERESTED TECHNICAL GROUPS

This film is furnished on a loan basis to any technical groups interested in studying the operating characteristics of Greenlee machines. To obtain it, simply direct a letter identifying the film, the time you would like to have it, and the approximate number of people who will view it. Write to Greenlee Bros. & Co. at the address shown below. There is no charge or obligation for the loan of this film.

ALSO AVAILABLE . . .
SCREW MACHINE MOVIE

Another Greenlee sound movie available on the same basis is a 30-minute film showing the building of a Greenlee Six-Spindle Automatic Screw Machine. It explains hidden details of construction and is an aid to operators and maintenance men.

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO. 1729 MASON AVENUE, ROCKFORD, ILLINOIS

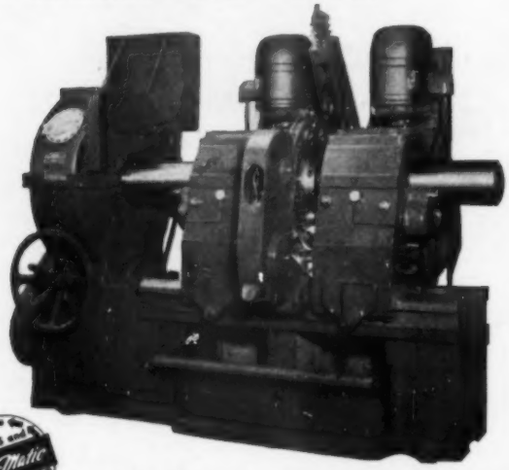
MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

Roto 1-A Matic

HORIZONTAL PRODUCTION MILLERS

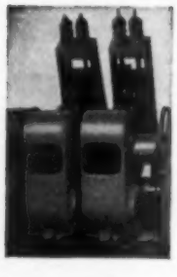
FEATURING

1 CONTINUOUS OPERATION
2 AUTOMATIC CHAIN CLAMPING
3 ROUGH & FINISH CUTTERS — EACH HEAD
4 3 TYPES — VARYING BED LENGTHS
5 LOW MAINTENANCE COST
6 INTERCHANGEABLE FIXTURES



INDEPENDENTLY DRIVEN HEADS

No. 1-A ROTO-MATIC Millers have been produced for the past 30 years in various sizes and types to do specific jobs faster and better than they have ever been done before. Because of their flexibility they have been designed to take a wide range of work with uniform satisfactory results. Engineering has made possible the milling of several work pieces at one time giving a high production of each. In all cases exacting requirements as to quality of work have been met.



Chain Clamping Fixture for rough and finish milling both ends of Control Arm Trunions to length. Interchangeable buttons make possible the milling of several sizes — Production 296 gross per hour.

Double Chain Clamping Fixture with a total of 28 stations for milling ends of Clutch Gears — Production 200 gross per hour — With this arrangement two different parts can be milled simultaneously.

Double Drum — 50 automatic holding fixtures on each drum for rough and finish milling radius on Rocker Arms — Production 1400 gross per hour.

ASK FOR BULLETIN 121

DAVIS and THOMPSON CO.
MANUFACTURERS OF *Machine Tools*
MILWAUKEE 14, WISCONSIN

IMPROVED EFFICIENCY

Photo courtesy American Broach & Machine Co.

WITH

RUTHMAN GUSHER COOLANT PUMPS

For improved efficiency in your metal cutting operations specify Ruthman Gusher Coolant Pumps.

Oversized pre-lubricated bearings reduce maintenance cost. Electronically balanced rotating parts assure quiet operation and longer life. Split-second control of coolants, from a trickle to full volume, gives coolant flow where you want it when you want it.

Illustrated is an American VP-5-25-40 Broaching machine equipped with a Model 11022-C ½ HP Gusher Coolant Pump.

Write now for Catalog 10-A

THE RUTHMAN MACHINERY CO.
1818 READIN. CINCINNATI 2, OHIO

The RANDALL & STICKNEY Platform Gauge

. . . . takes work up to 7 inches

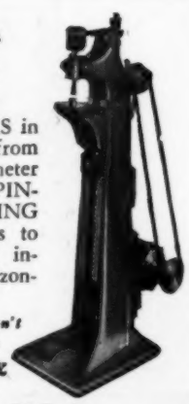
Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".
Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.
Base 8" square; height 13"; weight 18½ lbs.

Investigate Now!

FRANK E. RANDALL CO.
248 Ash Street
Waltham 54, Mass.

GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.



Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.

"Push-Tite"—with Valve in Socket

Series 8000—with Valves in Socket and Plug

HANSEN COUPLINGS

Quick disconnect with instant seal

Minutes saved by the use of Hansen quick-connective couplings add up to substantial savings in time, labor and costs. Operations repeated over and over can be simplified and speeded up with Hansen couplings—couplings that connect or release at a touch of the thumb. The plug pops out when released by movement of the socket sleeve. Line seal is instantaneous.

Merely push the plug into the socket, and the line is open to flow—a slight movement of the sleeve unlocks and releases the plug and flow is instantly shut off. Series 8000 has seals in both plug and socket, and is recommended for hydraulic service. The "Push-Tite" coupling seals in the socket only and is generally used in air, oil, and grease line connections.

Any plant using air, oil or hydraulic service can save time and reduce costs by the use of Hansen couplings. Simple and easy to operate—compact and sturdily built. Write for catalog.

HANSEN REPRESENTATIVES

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QUICK CONNECTIVE FLUID LINE COUPLINGS . . .

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

Safco 5-50

HEAVY-DUTY SOLUBLE OIL

for machining *all* metals – *even* stainless steel

Aluminum, brass, cold rolled steel – *even* stainless steel—work beautifully with *SAFCO 5-50* in the proper dilution. Light cuts and fine finish or heavy hogging cuts for maximum metal removal give uniformly satisfactory results.

In machining the stainless steel part illustrated, 50 per cent of the tough metal of the original casting was removed, using a 40-1 water ratio. Performance equalled that of the best sulphurized oil tested and was far superior to any other soluble oil.

High load carrying capacity and anti-weld qualities were responsible. In addition, the non-staining and anti-rust features protected both work and machine.

And all this at a remarkably low cost per gallon of solution.

Reduce your production costs by switching to

SAFCO 5-50

Ask for a simple demonstration in your plant.

SWAN-FINCH OIL CORPORATION
R.C.A. BUILDING WEST • NEW YORK 20, N. Y.

5121

ELECTROPUNCH
...the little punch with 1,000 uses

If you're looking for a versatile little punch to step up your production and reduce your costs, *ELECTROPUNCH* is the ideal tool.

Today, for example, manufacturers of electrical and other equipment are using *ELECTROPUNCH* to cut costs on hundreds of staking, riveting and wire cutting jobs—jobs which formerly required larger, more expensive machines.

A maximum blow of 2,250 lbs. is delivered at the touch of a button. When variable transformer is used, continuous range of impact from a few ounces up to maximum is possible.

OUTSTANDING FEATURES

- Weighs only 45 lbs.—easily moved about.
- Compact—requires less than 1 square foot of bench space.
- Semi-automatic operation reduces fatigue and rejects.
- Minimum parts to get out of order.

Write today for complete information and specifications.

Shown is bench model BH with 2,250 lbs. impact. Also available is Model B with 1,500 lbs. impact.

Height overall 22 ½"
Base 9" x 9¾".

BLACK & WEBSTER, INC.
126 MASSACHUSETTS AVE., BOSTON 15, MASS.
Dept. K

KEYSEATING
The Modern Way

Illustration shows typical set-up for cutting taper keyway with table tilted.

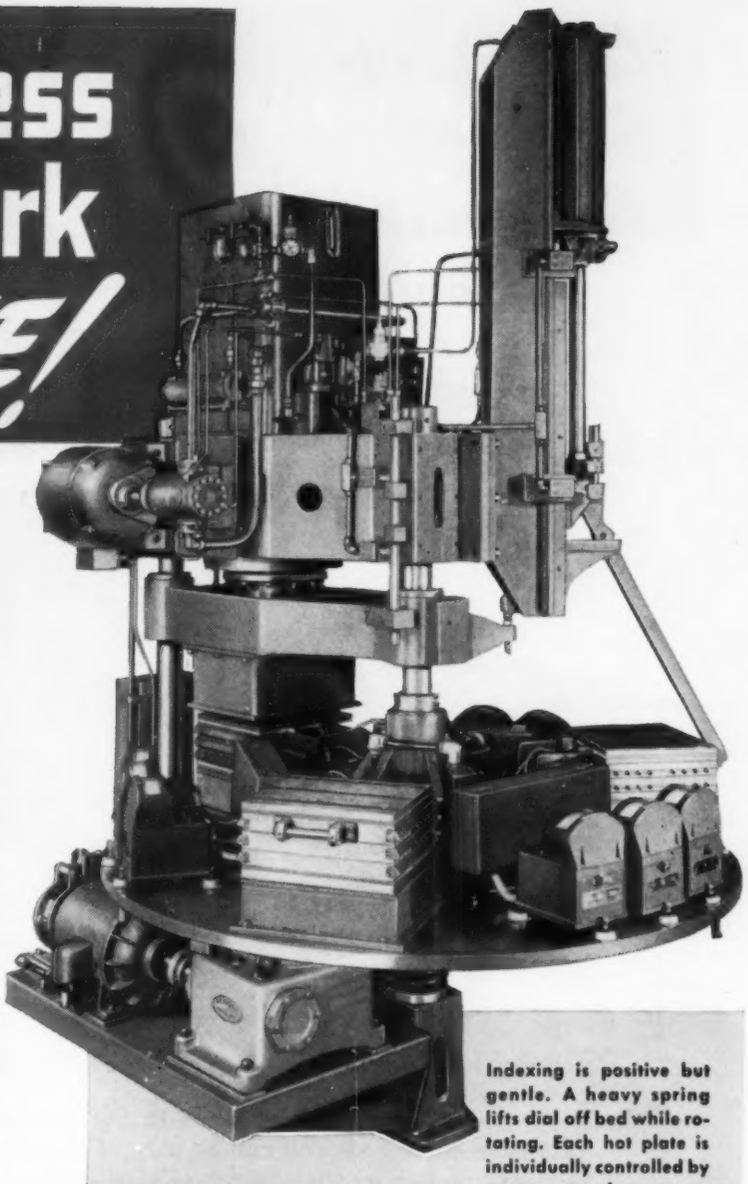
Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
403 EXCHANGE ST. ROCHESTER 8, N. Y.

This *ONE* Press does the work of *THREE!*



PROBLEM: The molding-on of insulation, each mold to contain several pieces, all requiring wiping—and the mold to be thoroughly cleaned after each pressing. Handling and pre-heating took so much time that three presses of the *standard type* would have been needed.

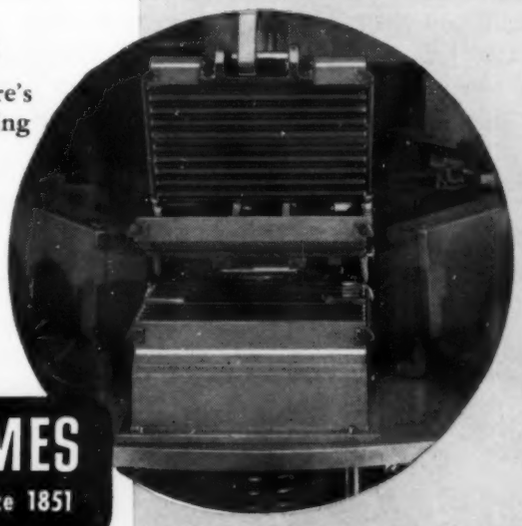
SOLUTION: Since the preliminary heating did not have to be done under pressure, Elmes hydraulic specialists visualized this operation as one stage of a *three-step sequence,* and they developed the revolving-table unit shown here. It's called a Three-Station Dial Feed Hot Molding Press. At one station the work is loaded and unloaded. At the next, preliminary heat is applied. And at the third, the work is subjected to pressure.

One *novel feature* is the mold design. To meet space limitations for the operator's convenience, Elmes engineers used a *three-leaf mold* that is hinged at the back to open like a book. And, as an *integral part* of the press, they provided an air hoist to open and close the molds, one leaf at a time.

Indexing is positive but gentle. A heavy spring lifts dial off bed while rotating. Each hot plate is individually controlled by a separate thermostat. One-man operated.

GET THE PERFORMANCE YOU PAY FOR

You may never need a dial-feed press, but here's something to remember. *Whatever* your pressing problems, you can look to Elmes for the right answers—whether the press be standard production or a built-to-order "special." Elmes ingenuity *does things* with hydraulic pressure. The economies are well worth *your* investigation.



Mold as fully opened by the air hoist for unloading, cleaning, and reloading of bottom section. Half-travel of air hoist opens top section only. When hoist is in lowest position, upward movement of the press swings hoist hook clear for dial rotation. Downward movement of press automatically engages hook.

ENGINEERED BY ELMES
Good Hydraulic Production Equipment Since 1851

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 1001-13 Fulton St., Chicago 7, Ill.
Distributors in Principal Industrial Centers • Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Looking FOR COST SAVING ? *Look* WHERE YOU'RE CUTTING

Yes, when you shift to the new look in cut-off method — abrasive cutting — you can be sure of considerable savings in the cost records you charge against your cutting operations. For regardless of the material you work with, the abrasive method means cutting time is faster, actually measured in seconds . . . it means you cut to size, within closer tolerances . . . and it means a finished surface that usually requires no further machining. Facts that add up to real savings!

As Abrasive Cutting Experts, we have had a wide experience in analyzing cutting problems and recommending equipment and wheels that have resulted in time and cost savings. If you're looking for cost savings *where you're cutting*, look to Allison.

THE ALLISON COMPANY
256 Island Brook Avenue
Bridgeport 8, Connecticut

See Allison IN ACTION AT THE NATIONAL METAL CONGRESS AND EXPOSITION PHILADELPHIA OCTOBER 25-29 BOOTH NO. 705.

Allison ABRASIVE CUTTING WHEELS

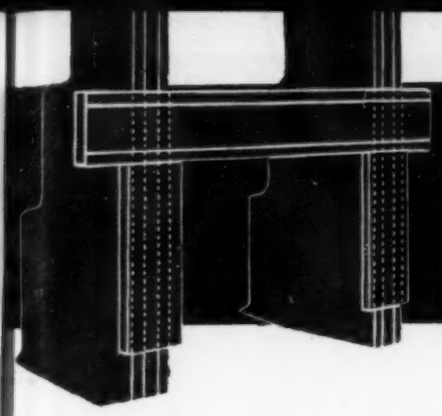
? *Do you cut. .*

- BRASS
- PLASTICS
- MONEL METAL
- GLASS
- ALUMINUM
- NICKEL
- TUNGSTEN
- IRON PIPE
- TUBING
- CERAMICS

IF SO, *Check* AND CALL FOR AN

Allison ABRASIVE CUTTING EXPERT

SAL48



ROCKFORD *Hy-Draulic* DESIGN-POINT

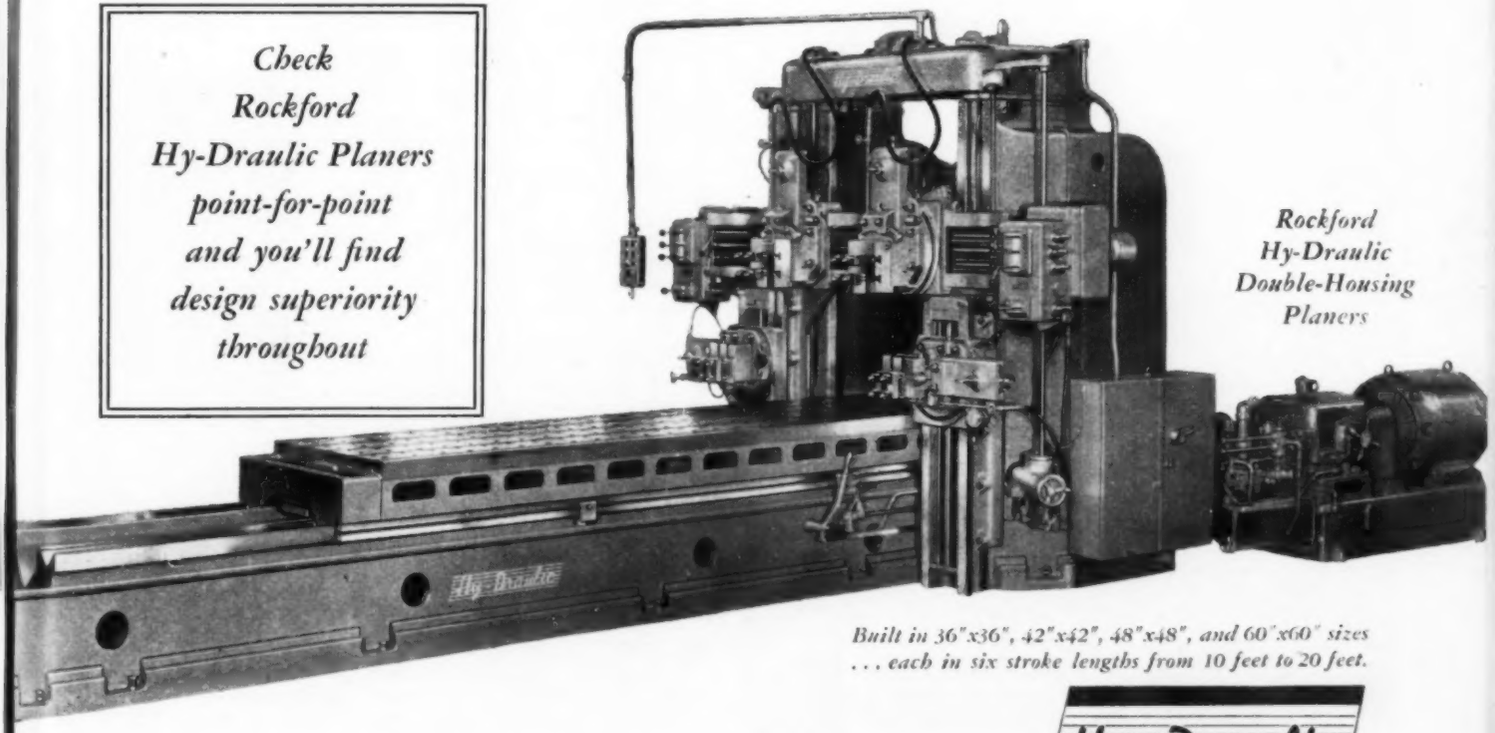
for more accurate– faster, planer work...

There are many reasons other than hydraulic drives and feeds that make Rockford Hy-Draulic Planers easier to operate, more accurate, and faster. One good example of better design is found in the cross rail construction of the Double-Housing Planer, as illustrated schematically above. At each end of the cross rail, as an integral part of the cross rail casting, is a long guide-way member. The total bearing surface provided between cross rail and column is as much as 300% greater than found in conventional planer design. The result is a precision alignment between cross rail and table . . . that is dependably maintained under all conditions. Rockford Hy-Draulic Openside Planer cross rail members are of similar design.

For complete information on Rockford Hy-Draulic Double-Housing and Openside Planers . . . for complete data on Rockford Hy-Draulic point-for-point design advantages . . . write for Catalog 1947

ROCKFORD MACHINE TOOL CO.
ROCKFORD, ILLINOIS

Check Rockford Hy-Draulic Planers point-for-point and you'll find design superiority throughout



Rockford Hy-Draulic Double-Housing Planers

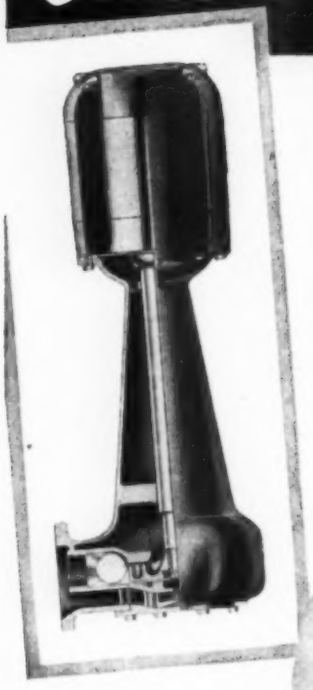
Built in 36"x36", 42"x42", 48"x48", and 60"x60" sizes . . . each in six stroke lengths from 10 feet to 20 feet.

ROCKFORD Hy-Draulic Ram Type SHAPERS • 36" OPENSIDE SHAPER • PLANERS • SLOTTERS • and SHAPER-PLANERS

Hy-Draulic
REG. U. S. PAT. OFF.

4804

For the Best in COOLANT and LUBRICATING PUMPS.. Come to Pioneer!



PIONEER
IMPELLER TYPE

Available in HORIZONTAL and VERTICAL designs, Pioneer Impeller Pumps are built for higher efficiencies, where maximum heads are required . . . conserve space for those hard to get at places . . . have long hour heavy-duty ball bearing motors for maximum life.

ROLLWAY
POSITIVE DISPLACEMENT

The Rollway, a slow speed, positive displacement pump, for liquids with lubricating properties. Available in a variety of models under three classifications—Non-reversing, Reversing and Automatic Built-in Relief Valve.

400 STANDARD MODELS TO CHOOSE FROM

Pioneer Pumps in Impeller and Rollway designs for pumping coolants, cutting fluids, abrasive liquids, lubricants and water available in every type and size. Please specify your needs when writing for information.

Pioneer Pump & Manufacturing Co.
19651 JOHN R ST. • DETROIT 3, MICHIGAN

provide the newest and only outstanding improvement in Flexible Shaft Machinery in 25 years. It's another Strand step forward in quality precision tools for faster, easier and more economical production work. The Strandflex 4-Speed gear drive employs a patented, new type of quick change gear drive utilizing 4 POSITIVE speeds by a unique and easy method of instantly changing from one speed to another. Powered with totally enclosed ball-bearing motors (having speeds from 850 to 9000 R.P.M., depending on motor) means years of smooth, trouble-free service. Send for Bulletin No. 43-A for full details.

Standard 3 speed counter shaft type Strand machines also available for portable rotary power at constant speeds for grinding, buffing, drilling, wire brushing and rotary filing, in all types and models from ⅛ to 3 H.P.—for every specific requirement. Send for Catalog No. 30.

Distributors in all principal cities

Strand
N. A. STRAND & CO.
5001 NO. WOLCOTT AVE.
CHICAGO 40, ILL.

For HIGH PRECISION *DEPENDABLE* HARDNESS TESTING

• In the field of precision hardness testing, there can be no substitute for absolutely dependable accuracy. Such accuracy is assured in the "TUKON" Tester—developed by WILSON, who have devoted more than 25 years exclusively to making fine hardness testing equipment. Two types—microhardness tester, combination microhardness and macrohardness tester. For testing fine wire, small precision parts, thin metal, superficially hardened surfaces, jewels, plastics, glass, etc. Also for research work.

TUKON TESTER
for
KNOOP and 136° PYRAMID HARDNESS NUMBERS

Write for descriptive Bulletin TK-48. Also DH-7, which gives experiences of actual users of the equipment.

Also makers of the "ROCKWELL" Hardness Tester

WILSON

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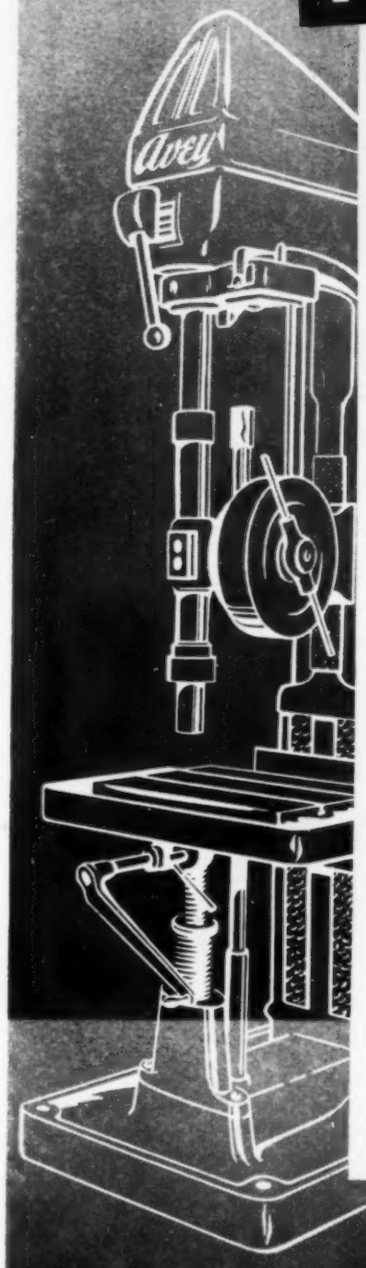
Fill out this form for Avey's FREE Engineering Estimate of your production problems!



INFORMATION FOR ESTIMATES

1. MATERIAL—HARDNESS

2. CASTING OR FORGING DRAWING PREFERRED WITH WORK MARKED

3. PRODUCTION REQUIRED PER HOUR . . . OR PER WEEK

4. PREFERRED METHOD

5. LOCATING POINTS

6. OPERATION DRILL—TAP—END MILL—HOLLOW MILL

7. VOLTAGE

8. HOW IS JOB BEING DONE NOW STANDARD . . . SPECIAL?

9. SUBMIT PROPOSAL TO

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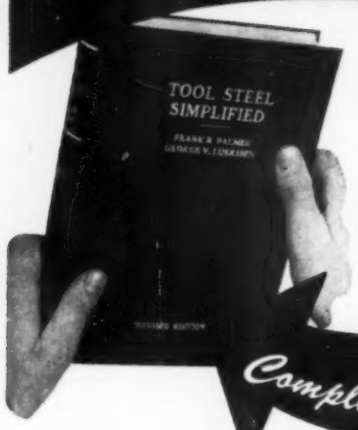

TOOL STEEL SIMPLIFIED
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George V. Luerssen
Chief Metallurgist
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564 Pages 355 Illustrations
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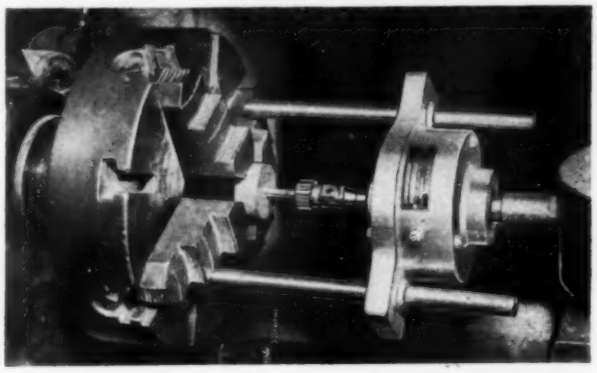
HERE'S HOW: *TO TAP—and back out—* WITHOUT STOPPING THE WORK OR REVERSING THE MACHINE



The Errington Auto-Reverse Turret Lathe Tapping Head is a new tool, practical, time-saving, money-saving. In a turret lathe setup, as illustrated, it allows you to tap the hole and back out the tap without stopping the work or reversing the machine. It's easy to operate: you simply feed the tap into, and out of, the drilled hole while the work is turning in the one direction. The new Tapping Head is a money-saver in this respect, too: with the aid of a friction chuck, you can tap blind holes without any possibility of tap breakage.

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The ERRINGTON AUTO-REVERSE TURRET LATHE TAPPING HEAD can also be used on drill press work for production-tapping. For this the Errington Head has a 2 to 1 reverse, and uses guide-bars to hold and steady the case.

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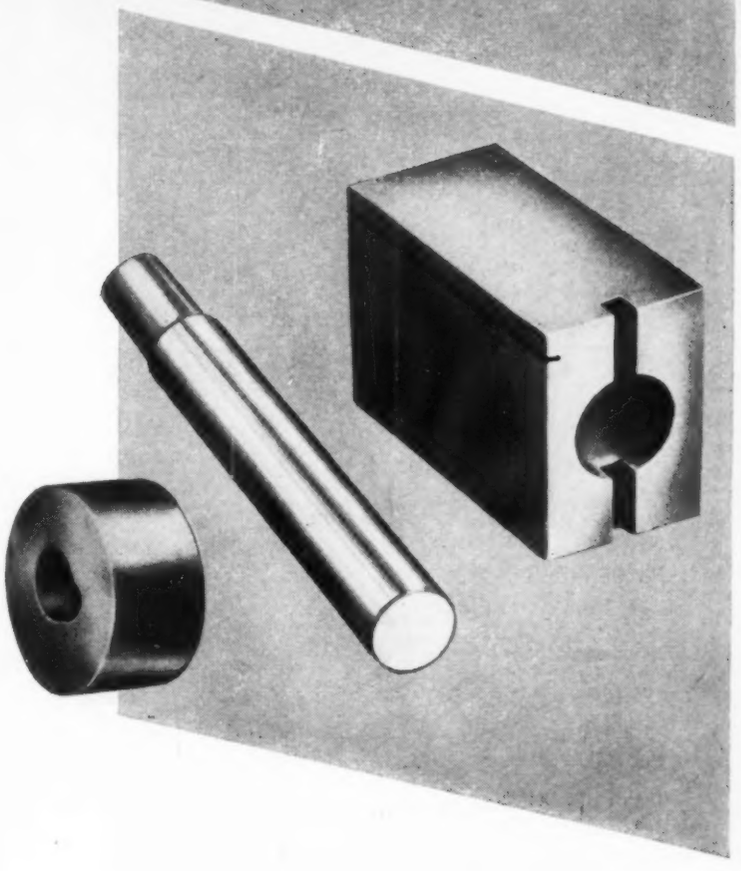

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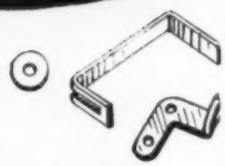

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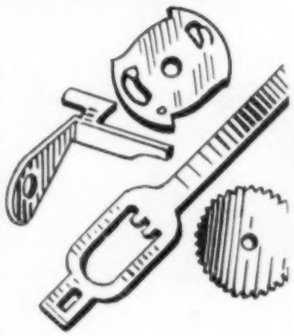

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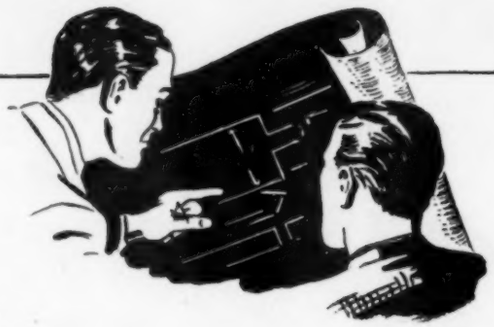

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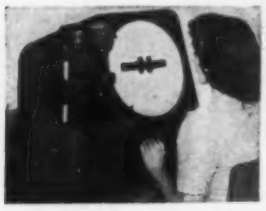

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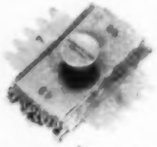

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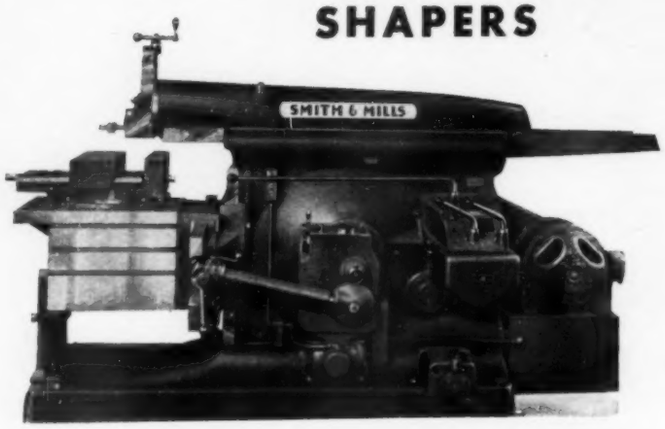
IN SMITH & MILLS SHAPERS



Just turn a shaft and the ram's positioned in the Smith & Mills Shaper. And the ram stays where you want it . . . self-locked automatically with no need for clamping.

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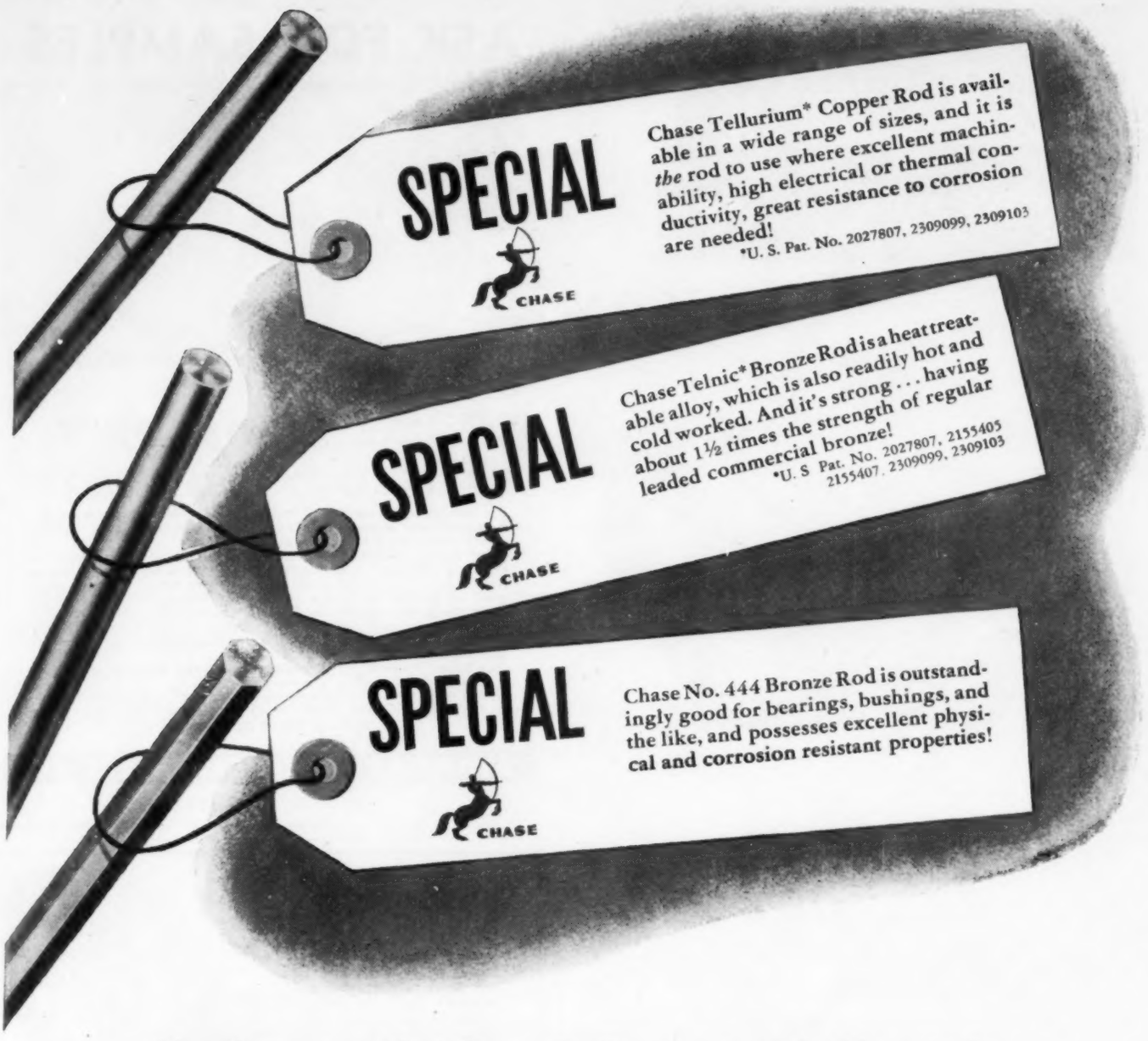
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Chase Tellurium* Copper Rod is available in a wide range of sizes, and it is *the* rod to use where excellent machinability, high electrical or thermal conductivity, great resistance to corrosion are needed!
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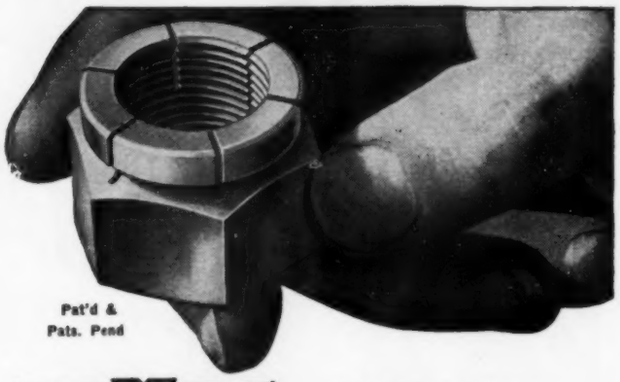

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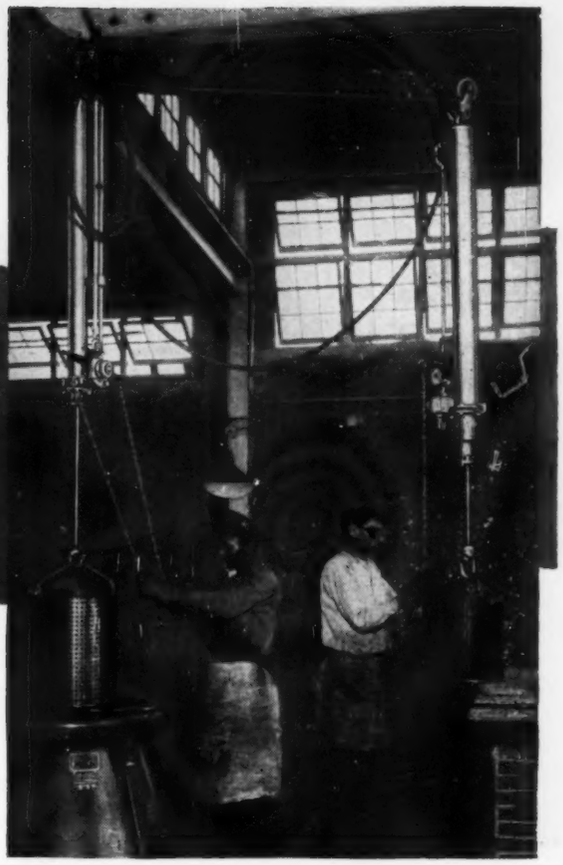

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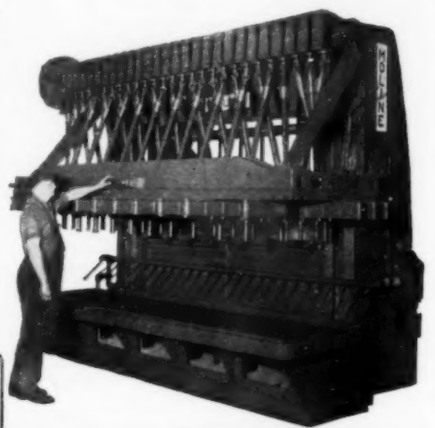

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Simplest and most accurate method of
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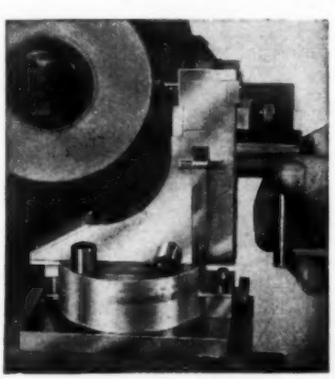

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*Reg U S Pat Off.

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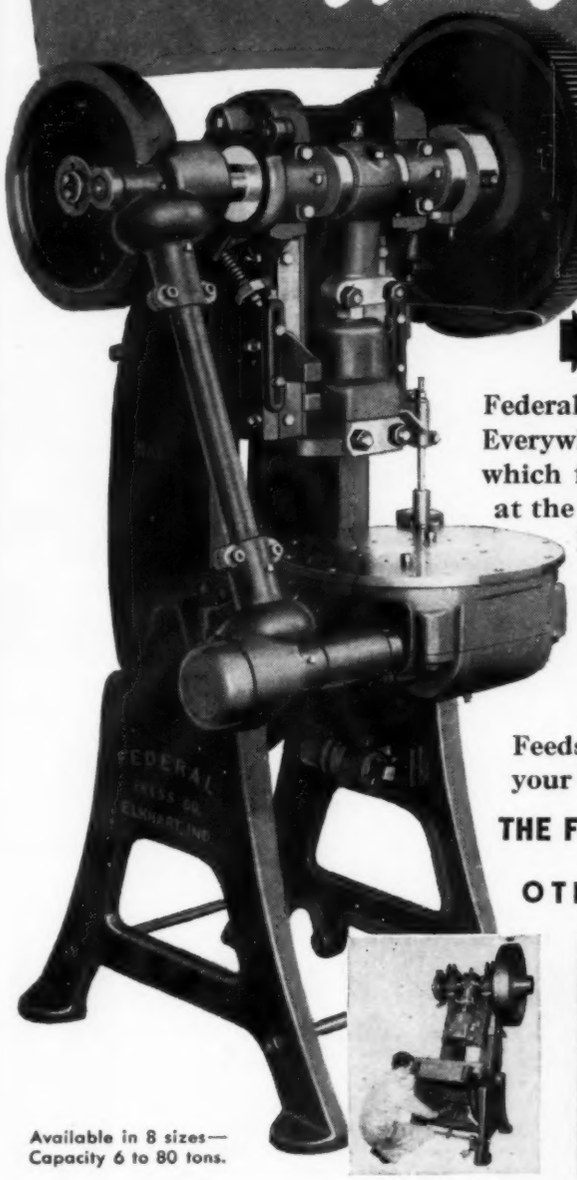
THESE *dial feed* PRESSES



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➧ CUT COSTS AS MUCH AS 75%

➧ MAKE HIGH SPEED OPERATION SAFE

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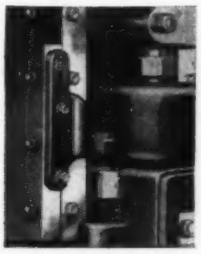
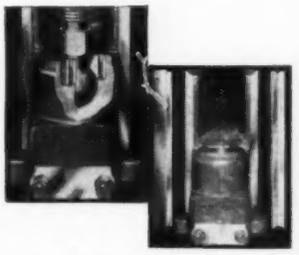
Available in 8 sizes—Capacity 6 to 80 tons.

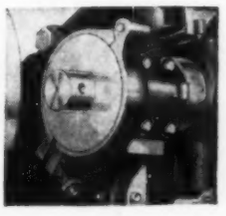
All Federal Presses may be reclined from the front—adjustment made quickly and easily by one man. Lock bolts hold press in desired position.



Knockout bracket is anchored to frame. Result: no danger of misalignment due to knockout bar impact. This reduces time out for adjustment, cuts costs.



The ram on Federal Presses is symmetrical, giving equal distribution of weight and balance; it is bored in exact alignment with "V" ways. Such careful construction adds to accuracy, speed and efficiency of press.



Shock from thrust and return strokes is transmitted to frame—no strain on bearings and caps. Brakes (spring tension) are quickly, easily adjusted.

FEDERAL *Dial Feed* PRESSES

Manufacturing know-how that shows you

How to make accurate cost estimates directly from the blueprint

Here's a money-saving book that gives you scientific methods for determining—*directly from the blueprint*—the material and production costs of any article manufactured in a machine-shop. It tells you how to go about estimating the exact expenditures involved in labor, machine time, materials, overhead . . . and shows you how to set up efficient production methods.

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No matter what combination of forming and machining processes a particular job calls for—drilling, milling, grinding, reaming, assembling, etc.—this book provides concrete methods for arriving at the exact cost of the entire job . . . a scientifically accurate figure you can depend on to reflect a true picture of the actual cash outlay . . a figure completely free of dangerous, haphazard guess-work.

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Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

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It's the SIDES of a V-BELT That Really Get the WEAR!

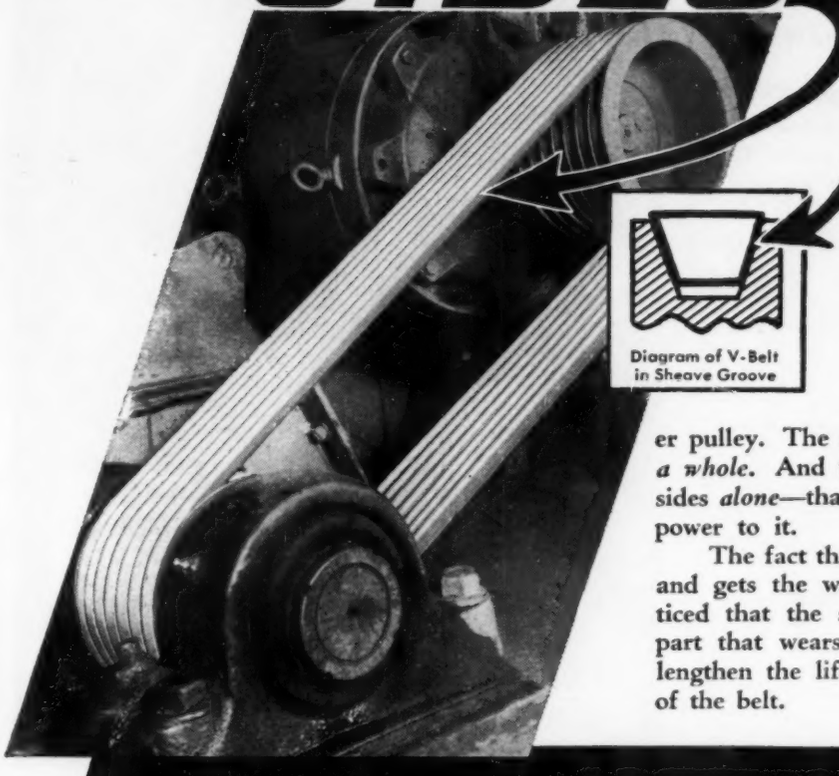


Diagram of V-Belt in Sheave Groove

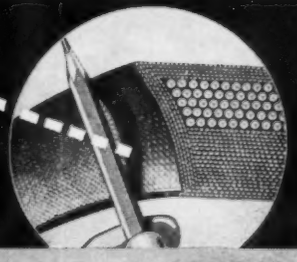
Look at this diagram of a V-Belt in its sheave. You see at once that the *sides* of the belt do all the gripping on the pulley and get all the wear against the sheave-groove wall.

It's the *sides*, moreover, that pick up all the power delivered by the driver pulley. The sides *transmit* that power to the *belt as a whole*. And then, once more, its the sides—and the sides *alone*—that grip the driven pulley and *deliver* the power to it.

The fact that the *side* is the part that does the work and gets the wear explains why you have always noticed that the sidewall of the *ordinary* V-Belt is the part that wears out *first*. Naturally, then, when you lengthen the life of the sidewall you lengthen the life of the belt.

Now See How the CONCAVE SIDE... SAVES Sidewall Wear and Lengthens Belt Life!

U. S. PATENT NO. 1813698



The simple diagrams on the right show exactly why the ordinary, *straight-sided* V-Belt gets excessive wear along the *middle of the sides*. They show also why the Concave Side *greatly reduces* sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

Saving Sidewall Wear is MORE IMPORTANT NOW Than Ever Before!

Now that Gates SPECIALIZED Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

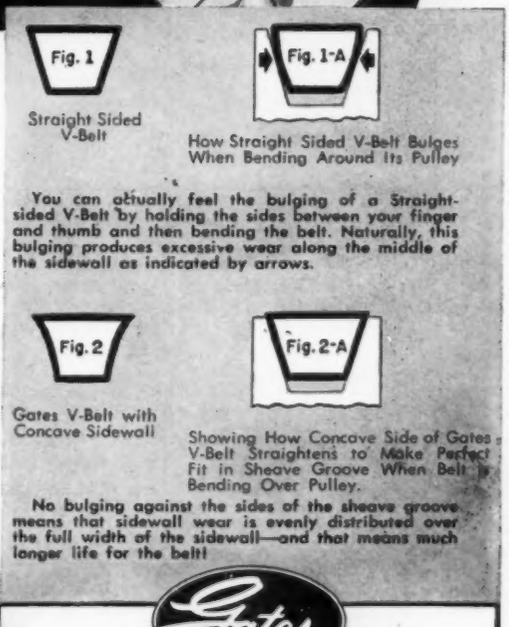


Fig. 1
Straight Sided V-Belt
Fig. 1-A
How Straight Sided V-Belt Bulges When Bending Around Its Pulley
You can actually feel the bulging of a Straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.
Fig. 2
Gates V-Belt with Concave Sidewall
Fig. 2-A
Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt is Bending Over Pulley.
No bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

THE GATES RUBBER COMPANY, DENVER, U.S.A.

"The World's Largest Makers of V-Belts"

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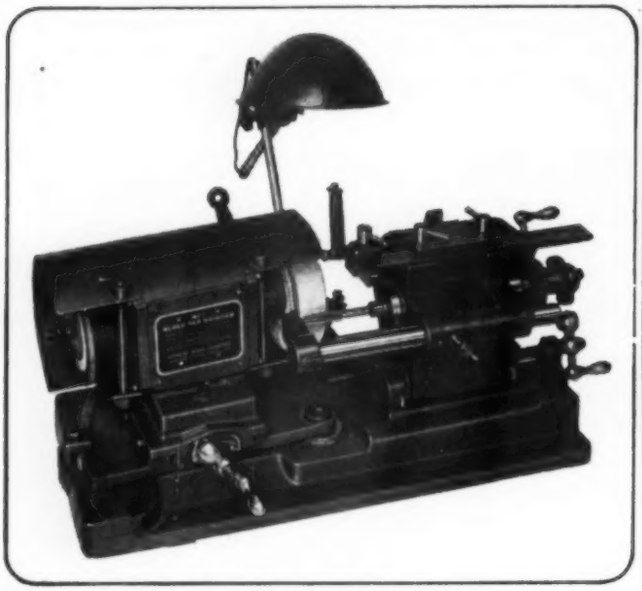

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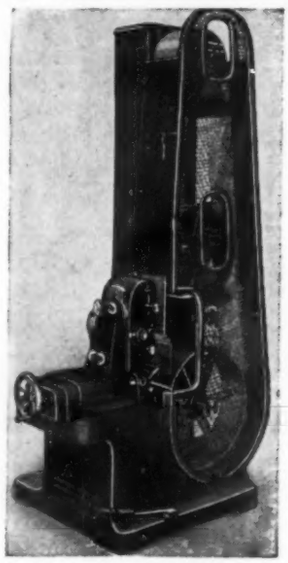
without centering or chucking attained automatically on the



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Cylindrical work can be fed through this machine automatically by means of a Power Feed. An attachment is also available for the automatic feeding of tapered cylindrical work.

The Type A machine represents the highest development for polishing such materials as metals, fibre, rubber, wood, etc. A mechanical finish far superior to anything possible with hand operations is definitely assured.

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Capacity (with power feed attachment): ¼" to 6" dia.
Speed (leather cushion belt): 6300' per min.
Floor Space: 40" x 50"
Motor: 10 H.P.
Height: 89"

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(Left) Precision truing of a spindle on a 75-ton Hannifin Straightening Press equipped with exclusive Sensitive Pressure Control *at Monarch Machine Tool Co., Sidney, Ohio.*

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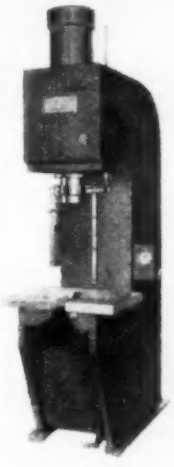
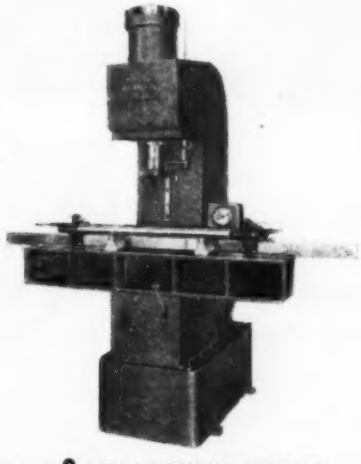


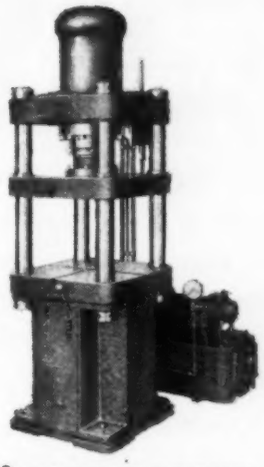
SERIES F FORCING PRESSES

10 standard models. Capacities from 6 to 150 tons. *Sensitive Pressure Control* standard equipment. Built-in power unit. Stroke adjustable. All-steel welded frame; normalized.



SERIES S STRAIGHTENING PRESSES

17 standard models. Capacities from 6 to 150 tons. *Sensitive Pressure Control* standard equipment. Choice of center type or roller vee fixtures; spring mounted.



SERIES C COLUMN TYPE PRESSES

48 standard models. Capacities from 6 to 150 tons. Any bed size. 2 or 4 columns. Manual, automatic or semi-automatic control. Furnished with or without platen.

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Out of this 20 page catalog on *standardized* Hannifin Hydraulic Presses, it is easy to select the press you need for forcing, straightening, forming, assembling, broaching, and similar operations. Contains detailed information on design and construction and useful engineering data. Ask for free copy of Bulletin No. 130-X.

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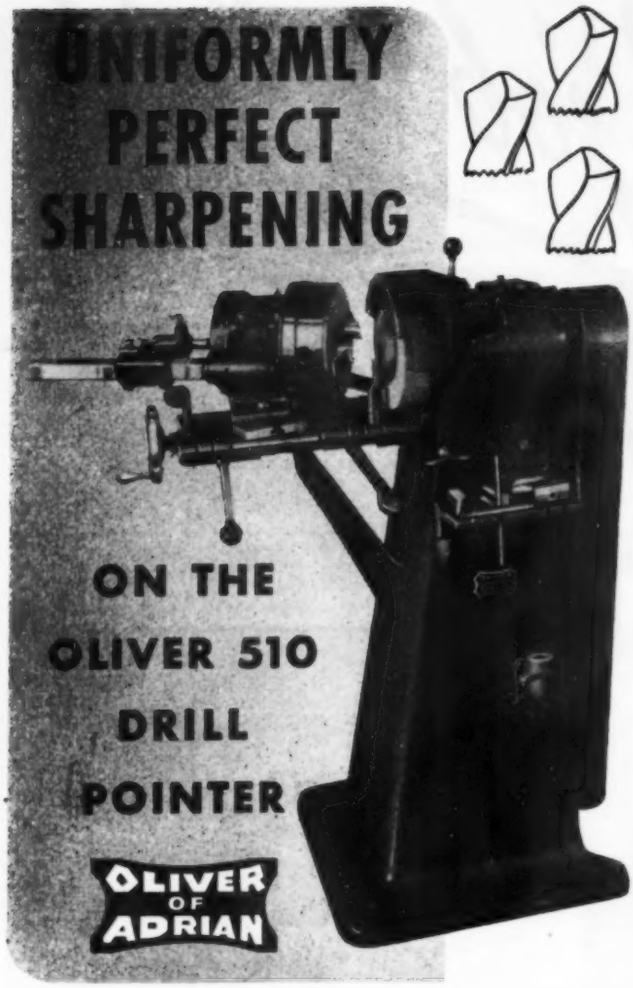

ON THE OLIVER 510 DRILL POINTER

OLIVER OF ADRIAN

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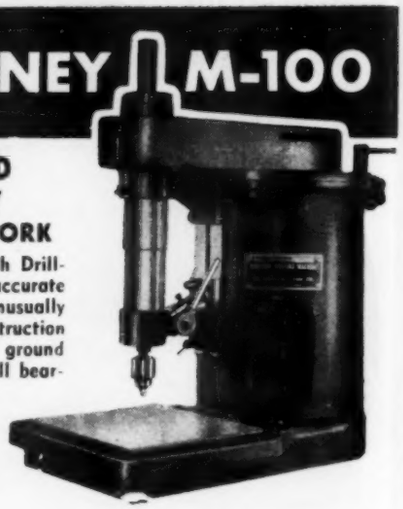
SIGOURNEY M-100



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5¾" x 13" **$47.65**
6½" x 18" **$63.15**
8" x 24" **$109.30**
10¾" x 37" **$202.05**

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A single pass over the stationary poles is sufficient to completely demagnetize work that has become magnetized through induction. Model B-2 for large work, complete with pilot light signal, switch and cord. Operates on 110 volts A. C. current. 7¾" wide, 13½" long, 6⅝" high. Shipping weight 55 lbs. $63.20

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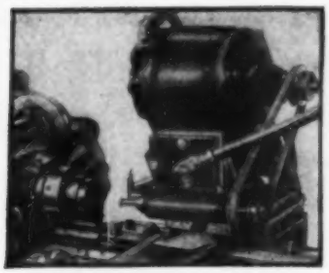
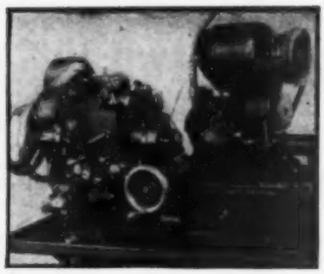
Two split piston rings are located on each side of the bearing assembly. *Inner* rings serve as internal flingers while *outer* rings keep foreign substance from entering the pillow block. Because these rings are not locked to the shaft, they are free to locate themselves whenever shaft expansion occurs.

SKF

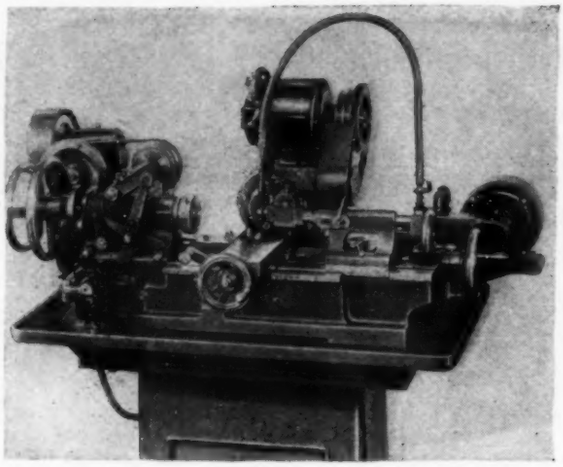
PILLOW BLOCKS



Machine equipped with Internal Milling Attachment



Machine equipped with Relieving Head



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Machines are mounted on cabinet base with two shelves inside. Standard equipment includes: three motors with push button start and automatic or push button stop—follow rest—one milling cutter—indexing device for cutting multiple threads—5 pitch lead screw—change gears for cutting from 5 to 40 threads per inch.

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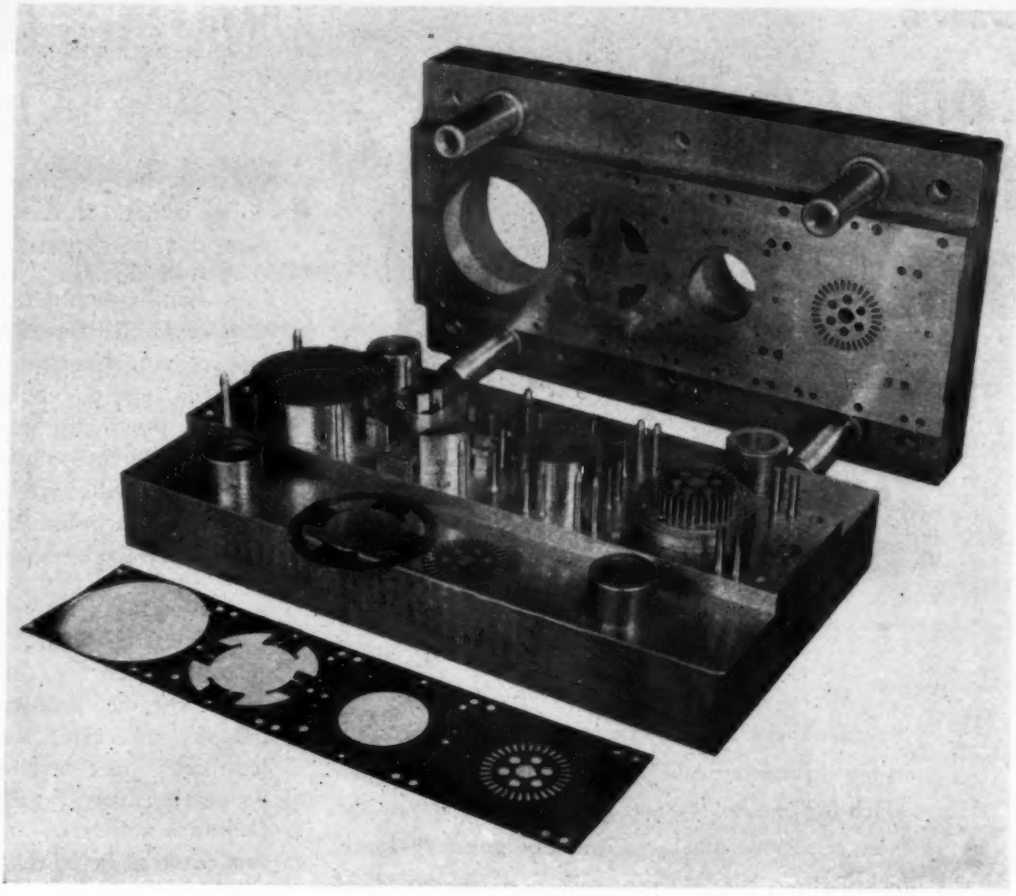

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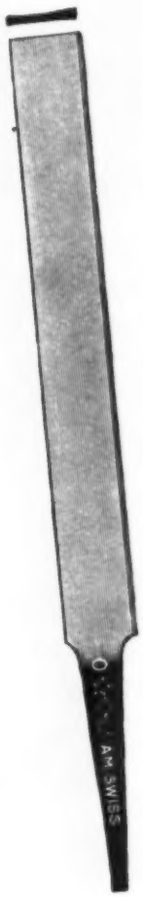

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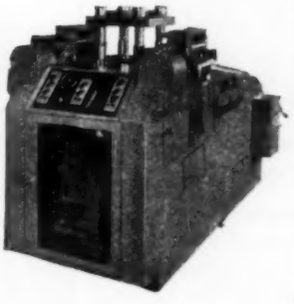

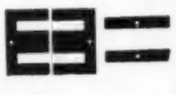

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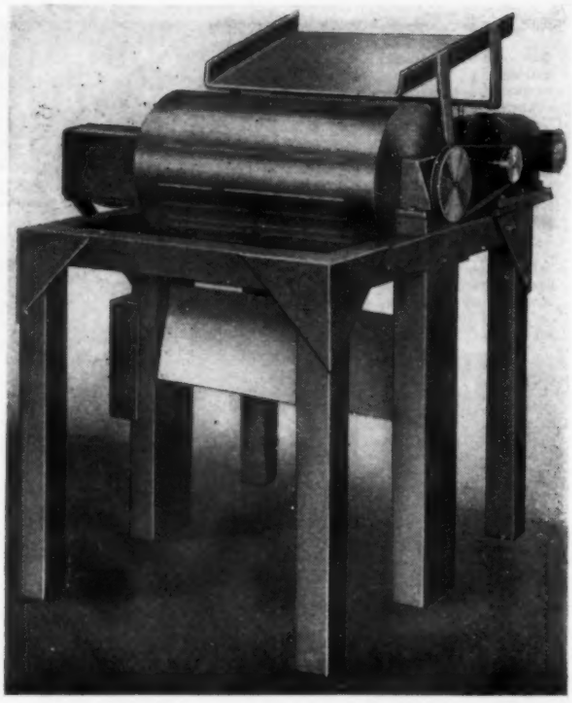

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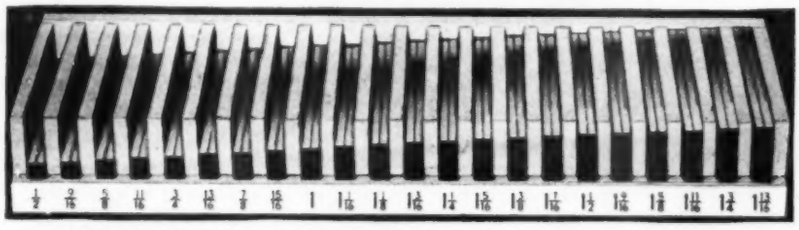

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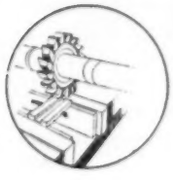

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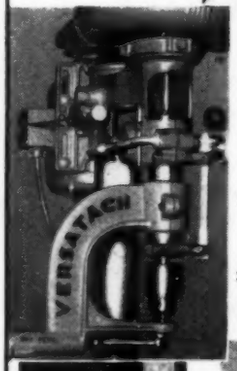

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"Unbrako" Socket Head Cap Screw with Knurled Head.

Pat'd & Pats. Pend.

(A) The KNURLED head of this ubiquitous "Unbrako" Socket Head Cap Screw greatly helps to *speed* assembly. The knurls "gear" right to the fingers, no matter how oily, and a positive slip-proof grip is the result—no waste motion. Of course, the Internal Wrenching feature provides cost savings in material, weight and space. (B) The KNURLING of this patented "Unbrako" Socket Set Screw—as shown—"swages" the threads, so that it becomes a most excellent *Self-Locker*—for use where the 5 standard points do not lend themselves to Knurling . . . it's an "Unbrako" Set Screw that positively *will not* shake loose—it's a real stay-put screw! Sizes available from No. 4 to 1½" diameter, in a full range of lengths.

Write us for the name and address of your nearest "Unbrako" Industrial Distributor and for your copy of the "Unbrako" Catalog.

Knurling of Socket Screws originated with "Unbrako" in 1934.

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Knurling of the head of the "Unbrako" Socket Head Stripper Bolt allows for fumble-proof grip —even if fingers and head are oily—thus, materially speeding production.

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"WON'T SHAKE LOOSE"

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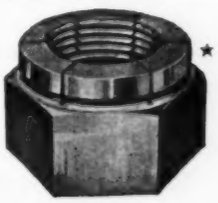

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AUCTION ADVERTISING ON PAGE 301

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20"x10' American, Q.C.G. 72" centers
20"x10' Hendey, Q.C.G. motor dr.
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18"x10' Davis, Q.C.G. M. Dr.
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18 x8' Lodge & Shipley, geared head
18"x8' Hendey Q.C.G. 49" centers
18"x7' Lehman, Q.C.G. M. Dr.
18"x6' American, Geared Head, MD.
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16"x6' Lodge & Shipley Geared Head
14"x8' Rockford, Q.C.G. Collets
14"x6' LeBlond, Q.C.G. M. Drive
14"x6' Mulliner-Endlund, M. Drive
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14"x6' Rockford, Q.C.G. M. Drive
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12"x30" American, Wood Spinning
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Cinci-Bickford 6' Arm, 15" col. Radial
Cinci-Bickford 5' Arm, 13" col. Radial
Demco 4-Spindle Drill #2 M.T. M. Dr.
Pratt & Whitney 2-Spdle. Profiler
Natco #12, 20 Spdle Multiple, 3/16" cap.
Fox #15, 54 Spdle. Multiple, #1 M.T.
Minster #2D Single Spindle Upright Heavy Duty. 2½" cap. Compound Table. Motorized
Canedy-Otto 21" Single Spdle. Late Type
Cinci-Bickford 21" Drilling & Tapping, #3 m.t.
Buffalo Forge #2MS Drill. Late Type
Barnes 22" Backgeared Upright Single Spdle.
Leland-Gifford #2MS, 2-Spindle Upright
Edlund #2B, 4-Spindle Upright, #2 m.t.
NEW Buffalo Forge #15, #18 Single Spdles.

CHIP SEPARATORS

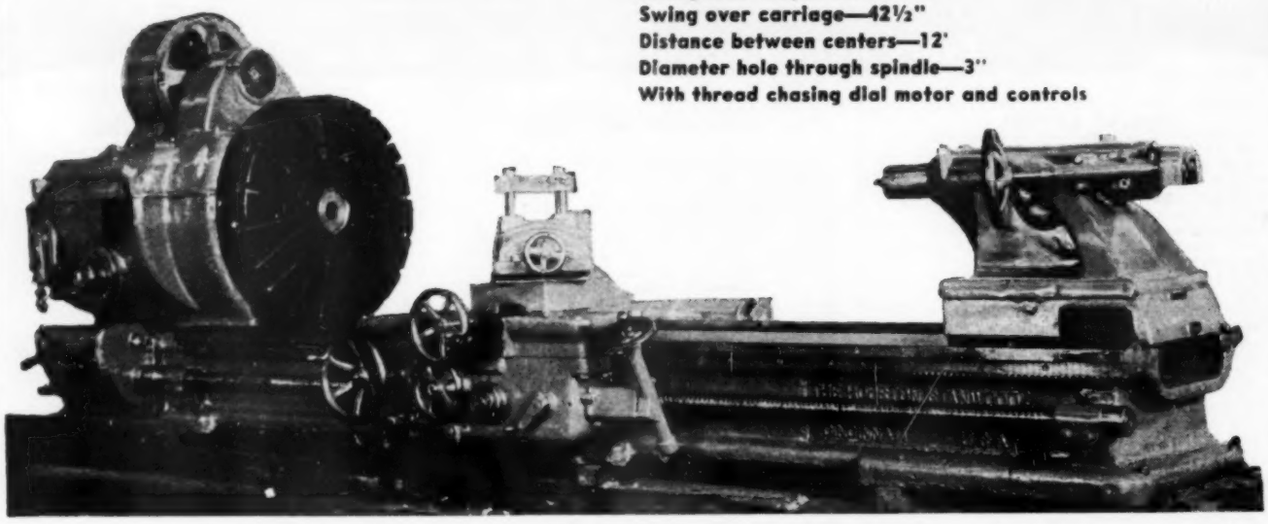
Barrett #501D Centrifugal, Ball-bearing 3/60/220 volts motor.
Fletches, 14" Bowel, ball-bearing, motor driven, 3/60/220/440 volts.

EMERMAN Offers From Stock

Heavy Duty Engine Lathe

54" x 18' HOUSTON STANWOOD & GAMBLE

Swing over ways—54"
Swing over carriage—42½"
Distance between centers—12'
Diameter hole through spindle—3"
With thread chasing dial motor and controls



16' x 24' NILES BEMENT POND EXTENSION TYPE BORING MILL
2000 TON HPM. FASTRAVERSE HOBBING PRESS
7" DETRICK & HARVEY PLANER TYPE BORING MILL

EMERMAN MACHINERY CORP. 875 W. 120TH ST. CHICAGO 43, ILL.

UNUSUAL VALUES

Milling Machines—No. 1, Universal. No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 3—36" Gould & Eberhardt 42".

Grinders—Cylinder B & S No. 11, Planer type 16"x36", Surface 12"x63", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x6', 8', 10'—16"x6', 8', 10'—18"x6', 8', 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 19" and 15" bench and floor type.

Planers—Single head 24"x6', 24"x8', 36"x8'.

Shapers—16", 20", 24", B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 28 24" Hi Duty 3" capacity in steel, motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.
P. O. Box 88, Columbus 16, Ohio

NEW SURPLUS

HIGH SPEED TOOL BITS

3/16"	square x 2"	long	$.05 each
¼"	square x 2½"	long	.10 each
5/16"	square x 2½"	long	.15 each
⅜"	square x 3"	long	.20 each
7/16"	square x 3½"	long	.35 each
½"	square x 4"	long	.50 each
⅝"	square x 4½"	long	.75 each
¾"	square x 5"	long	1.00 each
⅞"	square x 6"	long	1.25 each
1"	square x 7"	long	1.50 each

VICTOR MACHINERY EXCHANGE, Inc.
251 CENTRE STREET
NEW YORK 13, N. Y.
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USED MACHINERY BARGAINS AT REYNOLDS OF PROVIDENCE

5 #3 Bardons & Oliver Universal Turret Lathes. Bar feed, late type.

1 #5 Bardons & Oliver.

1 #4 Warner & Swasey Universal—Serial #351589.

1 #3 Cincinnati Dial Type Vertical Milling Machine. Spindle speeds 18-450 R.P.M. Very good.

REYNOLDS MACHINERY COMPANY
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PROVIDENCE 3, R. I.
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THE LARGEST MACHINE TOOL PLANT IN THE U. S. A.

Eastern OFFERS FROM STOCK

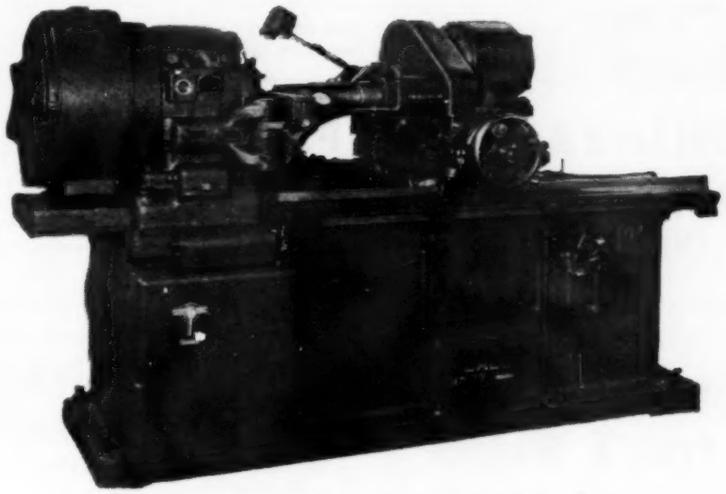
DEVOTED EXCLUSIVELY TO REBUILT MACHINERY

INTERNAL GRINDERS

No. 16A-16", 16-22", 16RS, 16-36 Bryant Hydraulic, m.d., latest types
No. 24-21", 24-36" Bryant Hydraulic, m.d., latest
No. 6, 10, 20 Bryant, belt
No. 49 Heald Single End Boromatic, m.d.
No. 70, 72, 72A5 Heald Plain, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A5 Heald, m.d., long bed type, latest
No. 73 Heald Airplane Cylinder, m.d., brand new (10 in stock)
No. 74 Heald, m.d.
No. 172 Heald Gap, m.d., cross sliding workhead, new, never set up

SURFACE GRINDERS

No. 10 Blanchard, m.d., 16" chuck
No. 11 Blanchard, m.d., 16" chuck, pract. new
No. 16 Blanchard, m.d., 26" chuck
No. 18 Blanchard, m.d., 30" chuck
No. 22-12" Heald Rotary, 12" chuck, m.d.
No. 25A Heald Rotary, m.d., 16" chuck, pract. new
No. 25A Heald Rotary, m.d., 24" chuck, pract. new
No. 33 Abrasive Vertical, m.d.
6x18" Landis, m.d.
6x18" Cincinnati Plain Hydraulic, m.d.
6x30" Cincinnati Hydraulic, m.d.
6x32" Fitchburg Type A, m.d., latest
No. 10 Brown & Sharpe, m.d.
No. 11 Brown & Sharpe, m.d.
8x18" Cincinnati Saddle Type, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x36" Cincinnati Saddle Type Hydraulic, with Filmatic Spindle, m.d.
10x48" Brown H& Sharpe, belt
10x72" No. 10 Brown & Sharpe, belt
10x72" Landis, m.d.
12x36" Landis, m.d.
12x48" Cincinnati, with universal type head and spline grinding attachment, Filmatic Spindle
12x48" Cincinnati Self-Contained, m.d.
12x48" Modern, belted, m.d.
12x96" Landis, m.d.
14x18" Cincinnati Self-Contained, m.d.
14x48" Cincinnati Self-Contained, m.d.
14x52" Norton, motorized
14x72" Cincinnati Self-Contained, m.d.
16x48" Landis Type D, m.d., with hydraulic infeed mechanism, 2 speed hand traversing mechanism
20x120" Landis, m.d., with gap 24" long
26x96" Landis, m.d.



10 New No. 73 Heald Airplane Cylinder Grinders

No. 260-16" Heald Rotary, belt
10x12x60" Norton Hydraulic, m.d., 60x10" chuck
14" Pratt & Whitney Vertical, cap. 12x36", m.d.
18x60" Thompson Hydraulic, m.d., 60" chuck
22" Pratt & Whitney Type B Vertical, m.d. 84x85" chuck
28x28"x144" Thompson Hydraulic, m.d., latest type, pract. new
54" Bridgeport Knife, belt

THREAD GRINDER

No. 33 Excello Precision, m.d.

TOOL & CUTTER GRINDERS

No. 3 Gallmeyer & Livingston, m.d.
Cincinnati Monset, m.d.
Sterling Tool, m.d., latest
No. 2B Sellers Drill, m.d.
No. 4T Sellers Tool, m.d., latest
3" No. 5i Oliver Drill Pointer, m.d.
Gleason Cutter, m.d.
Gould & Eberhardt Gear Cutter, belt
Sellers Bench Type, type 05D, m.d.
Grand Rapids Tap Style No. 12M, m.d.

PLAIN CYLINDRICAL GRINDERS

3x18" No. 5 Brown & Sharpe, m.d., latest
6x18" Landis Type C, m.d., latest, hydraulic

UNIVERSAL CYLINDRICAL GRINDERS

No. 1 Brown & Sharpe Self-Contained, m.d., latest
12x24" Cincinnati Self-Contained, m.d., Filmatic Spindle
No. 2-12x30" Brown & Sharpe, belt
12x30" Landis Hydraulic, m.d.
12x36" Cincinnati, Self-Contained, m.d.
12x36" Cincinnati, belt
12x48" Cincinnati, m.d., arranged for splines
12x48" Cincinnati Hydraulic, m.d., latest
12x48" Norton Hydraulic, m.d., latest
16x48" Cincinnati, belted, m.d.
18x48" Cincinnati Hydraulic, m.d., latest

DISC GRINDERS

No. 4 Gardner, m.d., 10" discs versal tables
No. 20 Gardner Comb. Disc and Roll Sander, m.d.
7½ H.P. Standard Double End, m.d., plain & uni-
7½ H.P. United States as above

MANUFACTURING TYPE LATHES

No. 9 Heavy LeBlond Multi-Cut, m.d.
No. 4 R.K. LeBlond Boring Lathe, 37" bed, 13" hole, m.d., latest
3½x36", 3½x80", 4x60", 8x84", 8x132" LeSwing, m.d.
9x12" Sundstrand Mfg., s.p.d.
11"x18' centers LeBlond Rapid Production, m.d.
13x24" Coulter Automatic Threading, m.d.
13x24" LeBlond Rapid Production, m.d., latest
13x48", 15"x6' Coulter Automatic Threading, m.d.
16"x6' LeBlond Rapid Production, m.d.
17"x6' LeBlond Automobile Mfg., cone
21"x8' LeBlond Turret, cone
Niles-Bement-Pond Quartering Machine, m.d., new
Schauer type NA 2B Speed Lathe, m.d.

MANUFACTURING TYPE MILLING MACHINES

No. 12B Brown & Sharpe, m.d.
No. 2-18 Cincinnati Auto. with rise & fall, m.d.
No. 00 Sundstrand Hydraulic Rigidmill, m.d., latest
No. 08 Cincinnati EA Plain Automatic, m.d., with rise & fall
No. 08 Cincinnati without rise & fall, latest
No. 1-12 Cincinnati Plain Auto., m.d., latest
No. 1-18 Cincinnati Plain Auto., m.d., latest
No. 2 Sundstrand Electromill, m.d., latest
No. 2-18 Cincinnati Plane Auto., m.d., latest
No. 2-24 Cincinnati Plain Auto., m.d., latest
No. 3-24 Cincinnati Plain Hydromatic, m.d., latest
No. 3-36 Cincinnati Duplex Hydromatic, m.d.
No. 3A Sundstrand Copy Rigidmill, for airplane propellers
No. 4-48 Cincinnati Plain Hydromatic, m.d., latest
Type P Ohio Mfg. Type, m.d.
No. 33 Kempsmith Mfg., s.p.d.
No. 34-36 Cincinnati Plain Hydromatic, with tracer control, latest
No. 34-36 Cincinnati Duplex Hydromatic, with tracer control, latest
No. 56-72 Cincinnati Duplex Hydromatic, m.d., latest
No. 56-90 Cincinnati Duplex Hydromatic, m.d., latest
48" Cincinnati Automatic Duplex, m.d.
4" Pratt & Whitney Spline, m.d.
18", 24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
30"x36"x12' Ingersoll Slab, m.d., 2 heads on rail
36"x24"x8' Ingersoll, m.d., 1 rail, 2 side heads
48"x48"x20' Ingersoll Fixed Rail Type, with 8 spindles
72"x6' Ingersoll Single Horizontal Spindle Traveling Housing Milling Machine, m.d., with 5 motors
96"x22' Ingersoll Single Spindle Open Side Horizontal Traveling Milling Machine, with motors, 66" hand index table

SAWS

6x6" Peerless Hack, m.d.
Wells Type 8M Metal Band, m.d.
P43 Kalamazoo Metal Cutting Band, m.d.
7½ H.P. Cincinnati Elec. Tool Co. Abrasive Cut-off, type JCAW
DeWalt Model ME 1 Abrasive Cut-off, m.d.
No. 3 and 8 Nutter & Barnes Cold
No. 6 Cochran-Bly Cold
No. 11½ Higley Cold
Gustav Wagner Cold Saw, m.d., 28" saw blade
No. 138 Espen-Lucas Cold Saw, m.d.

SLOTTERS

10" Newton, cone
12" Bement-Miles, m.d.
20-24" Dill, m.d.
15" Canada, m.d.
48" Niles-Bement-Pond Geared, reversing m.d.

TAPPERS

No. 1 Blakewell Precision, m.d.
No. 5 Webster & Perks 5 spindle Vertical Nut, belt
No. 10 Kaufman High Duty Oscillating Pneumatic, m.d.

SHEET METAL MACHINERY

Southwark Rotary Metal Cutter, 36" throat, 5/8" cap.
Gray Turret Head Metal Cutter, 36" throat, ¼" cap.
No. 2 Libert Nibbler, 28" throat
120" No. 100 Niagara Heavy Production Folder, 16 ga., m.d.

MISCELLANEOUS MACHINERY

Pratt & Whitney "Keller" Machine, type BL-2420, very late
96" dia. Ohio Extra Heavy Worm Feed Revolving Table, m.d.
40" Chip Wringer, Tolhurst, m.d.
No. 20 PH A.D. Cook Deepwell Pump, driven by Chrysler Engine
Bear Precision Balancing Machine, model 340-R
Gisholt Precision Balancing Machine, m.d.
No. 2 Cochran-Bly Filing Machine
Detrick & Harvey 2 spindle Profiler, belt
Pratt & Whitney 2 spindle No. 12 Profiler, m.d.
No. 2M Morey 2 spindle Profiler, m.d., latest
No. 11, 118 Cochran-Bly Saw Sharpeners
Wagner Saw Sharpener, m.d.

We carry an average stock of 2,000 machines in our 11 acre plant at Cincinnati. Visitors welcome at all times.

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(1) POTTER & JOHNSTON #5D2 AUTOMATIC CHUCKING MACHINE. Two Spindle, Mfg. in 1942. Excellent Condition. Serial No. 52913. PRICE.....$4,850.00

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(1) NO. 8-D GORTON UNIVERSAL VERTICAL MILLING MACHINE. Serial No. 15834. PRICE.....$1,750.00

(1) 200 Ton HYDRAULIC STRAIGHTENING PRESS. Mfg. by Hydraulic Press Co., Length of Bed 240", Width 24", Clearance Between Rods 30". PRICE.....$4,500.00

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(1) JONES & LAMSON MODEL NO. TG615 AUTOMATIC THREAD GRINDER. Serial No. 130158. Excellent Condition. PRICE.....$2,750.00

(1) NO. 75-A HEALD INTERNAL GRINDER. Serial No. 22065. Excellent Condition. PRICE.....$2,250.00

(2) NO. 72A-5 HEALD INTERNAL GRINDERS. Serial Nos. 13939 and 13940. Excellent Condition. PRICE.....$1,500.00 ea.

(2) NO. 74 HEALD INTERNAL GRINDERS. Serial Nos. 24602 and 24603. Excellent Condition. PRICE.....$2,250.00 ea.

(1) LANDIS 18 x 18 EXTERNAL GRINDER. Excellent Condition. PRICE.....$2,500.00

(4) PRATT & WHITNEY 9" GEAR GRINDERS. PRICE...$1,000.00 ea.

(4) DETROIT GEAR GRINDERS, Model GG-18. PRICE...$1,150.00 ea.

(1) TURCHAN FOLLOWER FOR BULARD BORING MILL. PRICE.....$1,000.00

(1) 24" STEPTOE SHAPER, With Universal Vise. New in 1942, Serial No. EB41385TB. PRICE.....$3,500.00

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(1) GLEASON 15" QUENCHING PRESS. Excellent Condition. PRICE.....$1,250.00

(1) GISHOLT NO. 4-R SADDLE TYPE TURRET LATHE, Serial No. 2914-37, with 26" 4 Jaw Chuck, 9" Hole in Spindle, 4-Way Tool Post. Excellent Condition. PRICE.....$4,500.00

(2) PRACTICALLY NEW CENTURY LATHES, 16"x48", PURCHASED NEW IN 1946 AND 1947. PRICE....$2,500.00 ea.

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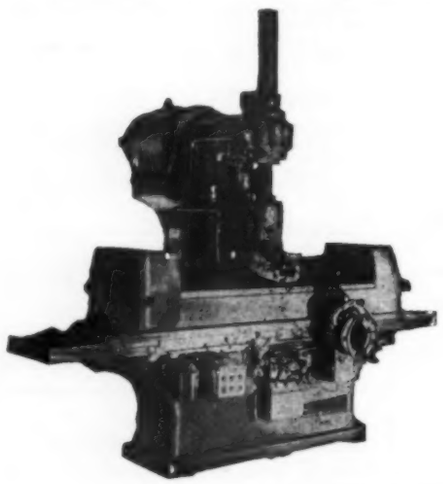

LATEST TYPE Pratt & Whitney

14" x 60" HYDRAULIC VERTICAL SURFACE GRINDER

Like New

OTHER FINE MACHINE TOOLS IN STOCK

72" N-B-P Vert. Boring Mill.
60" Cincinnati Vert. Boring Mill.
48"x30' N-B-P Lathe, M. D.
12" Oster-Williams Pipe Machine.
4' American "Hole Wizard" Radial Drill, '42.
25" Smith & Mills Shaper, Rap. Trav., '42.
20" Smith & Mills Univ. Shaper, Power Down Feed, '42.
3—#2G B&S High Speed Automatics.
16"x54" c.c. Lodge & Shipley lathe.
2—#2G Kempsmith Univ. Millers, '43.
16"x33" Fay Auto. Lathe, '42.
#2H Kearney & Trecker Vert. Mill, '42.
#4 Cincinnati Plain Mill, Rect. Arm.
4—#2M Cincinnati Plain Millers, Timken, mtr. in base.
3—#000 B&S Production Mills, '42.
12"x36" Norton "C" Univ. Cyl. Grinder, '41.
14"x40" B&S #3 Univ. Cyl. Grinder, '42.
6"x30" Norton "C" Plain Cyl. Grinder, '42.
#22 Heald, 12" rotary Grinder, '42.
7" Peerless Hydracut H.S. Power Hack Saw, 1942.
#91A Covel Univ. Tool & Cutter Grinder, 1942.

EVERYTHING FROM A PULLEY TO A POWERHOUSE

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET - - PHILADELPHIA 6, PENNA.

BARGAINS!

SURPLUS EQUIPMENT

BRIDGEFORD 36x24' Centers Engine Lathe, Motor Drive
BULLARD 16" 6 and 8 spindle Mult-au-matic Type D Single Indexing, New 1943
CINCINNATI 120x96x26' Table Housing Planer, 4 heads, Power Rapid Traverse, Box Table, DC Reversing Motor Drive
CINCINNATI #3, #4 Vertical Milling Machine, Geared Motor Drive
CRANES from 5 to 30 ton capacity all 230 volts, DC current
FRANKLIN 4¼" Bar Horizontal Boring Mill Table Type Motor Drive
HEALD #48A Borematic Double Spindle Single End New 1941.
JONES & LAMSON "Fay" 20x25 Centers Production Lathe, New 1941
LoSWING 8x108" Centers Production Lathe, New 1941
NILES 30x50' Bed Boring Lathe, New 1941
NILES 72x63' Centers, Combination Boring and Turning Lathe, Motor Drive

NIAGARA 1200 KVA Outdoor Type Transformer, Oil cooled, 2400-240 volts, 3 phase, 60 cycles, Latest Type

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HARRISON MACHINERY EXCHANGE, INC.

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LATEST TYPE NEARLY NEW MACHINES

AUTOMATIC SCREW MACHINES

BILLINGS & SPENCER #B2 Di-matic Cut Off.
BROWN & SHARPE #4, 1½" capacity, Latest Type
BROWN & SHARPE #2G High Speed, Latest Type
GOSS & DeLEEUW 8" Automatic Chucker, 5 spindles
NATIONAL ACME 9/16, 5 spindle, Model D, M.D.

BORING MILLS—Horizontal

CINCINNATI GILBERT 3½" bar, floor type, latest
DETRICK & HARVEY 4" bar, Floor Type, M.D.
FRANKLIN 4¼" Bar Table Type—M.D.
GIDDINGS & LEWIS #25, 2½" bar, M.D.
HEALD, #48A, #49 single, double end Borers, latest
LANDIS—#35—3½" bar, #40—4" bar, floor type, M.D.
LUCAS #41, 3" bar, Latest Type
NILES BEMENT POND 5", 6", bar, floor type
P & H #10 3½" bar floor type, M.D.
UNIVERSAL 3" bar, high speed, latest type
UNIVERSAL No. 3A, 3" bar M.D.

BORING MILLS—Vertical

BETTS 120", 2 swivel heads, AC, M.D.
BULLARD 16", 6 and 8 spdle., Type D, Multi-au-Matics, Latest Type
KING 52", 62", 2 swivel heads, PRT, M.D.
NILES 84", 2 swivel hds., P.R.T., M.D.
NILES 100", 2 swivel heads, D.C., M.D.

BROACHES

CINCINNATI 1-30 Duplex, Vertical, Surface, Double Ram, Model EB, Hyd., Latest
CINCINNATI 3-30 Duplex, Vertical, Surface, Double Ram, Model EB, Hyd., Latest

DRILLS

AVEY MA-8, 2 spdles., Latest Type
AVEY MA-6 3 spdles., Latest Type
BAKER 310 Single Spdle., Motor Drive
BARNES H-3 Hydram, Hyd., Latest Type
COLBURN #14, 2 spdle. Motor Drive
EDLUND 1B, 2B, 2MS, Latest Type
FOOTE BURT #2, #3, M.D.
HIGH SPEED HAMMER R-53, Latest
LELAND & GIFFORD #2, #2MS, Single Spdle
SNYDER 10V-18 Vert., Hyd., Latest

DRILLS—Deep Hole

BARNES 420/2 Spindle Hydraulic, Latest Type
BAUSH #1½x30 2 Spindle, Latest Type
Le BLOND #2 Single Spindle, Hydraulic, Latest Type
PRATT & WHITNEY ½Bx30, ½Bx50 2 Spindle, Latest Type

DRILLS—Multiple Spindle

FOOTE BURT 20 spindles, Hyd., Latest
BOLEY 10 spdles, High Speed, Latest
KINGSBURY Model GC, Latest
PRATT & WHITNEY #12, 8 spdles., M.D.

DRILLS—Radial

AMERICAN 5' arm 13" column, Plain M.D.
CIN. BICKFORD 6' arm 15" col. Plain or Univ. M.D.
DRESES 4' arm, 13" column Plain, M.D.
DRESES 5' arm, 15" column, Univ. M.D.
FOSDICK 5' arm, 14" column, Plain, M.D.
NILES 6' arm, 15" column, Univ., M.D.
WESTERN 6' arm, 20" column, Plain, Latest Type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type A Hobber, Latest Type
BARBER COLMAN Type S Hobber, Latest Type
BARBER COLMAN #12 Hobber, M.D.
BROWN & SHARPE No. 3H Gear Cutter, M.D.
FELLOWS #615 A, #61, #7A, #72 #7, #725, #75, 61A, #77 High Speed Gear Shapers; Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #6Z2 Gear Shaper; high speed; latest type
FELLOWS #13LS Lapper, Latest Type
GLEASON 3", 12", straight bevel generator, latest type
GLEASON #17 Hypoid, Spiral Bevel, Zerol, Latest
GLEASON 10", 15", Spiral Bevel Generator, M.D.
GLEASON 11", 18" Straight Bevel Generator, M.D.
GLEASON #20 Spur Gear Tester, Latest Type
GLEASON #4, #6, #13, #18 Bevel and Hypoid Tester
GOULD & EBERHARDT #36H Hobber, M.D.
GOULD & EBERHARDT 12HS Hobber, Latest Type
KOEPFER Model WMII Automatic Hobber—Latest
PRATT & WHITNEY 10" Grinder, Hyd., Latest

GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2, 3, Universal, Latest
BROWN & SHARPE, #5 Plain, 3 x 12, Latest Type
Brown & SHARPE #20 10x18 Plain, Latest Type
CINCINNATI 6" x 18" Plain, Model EA, Hyd., Latest
LANDIS 4 x 12, 4 x 18, Type H Plain Hyd., Latest
LANDIS 10 x 24" Universal, Type C, Hyd., Latest
NORTON 10" x 36" Type C, Plain, Hyd., Latest

GRINDERS—Miscellaneous

BARBER COLMAN #3 Hob Sharpener; Latest Type
BRYANT #5, #16-16, #16-CP-16, #24, Internal Hydraulic, Latest Type
CINCINNATI #3 Centerless, "Filmatic", Latest
CINCINNATI #2 Centerless, "Filmatic," Latest
CINCINNATI #3 Centerless, M.D.
CINCINNATI Centerless Lapper, Model ED, Latest
COVEL #22 Universal Tool & Cutter, Latest Type
COVEL #91A Univ. Cutter and Tool, Latest
EXCELLO #46C Carbide, Latest
FITCHBURG 14" x 25" Spline, Hydraulic, Latest
GLEASON #12 Tool Sharpener, Latest Type
HEALD 50, 70 Internal, M.D.
HEALD 75A, 72A3, 72A5, 74, 81, 70A Internal; Latest
HEALD #72A3 Internal "Gagematic", Latest
JONES & LAMSON 6x15, 8x48, Auto. Thread, Latest
LANDIS 5" Oscillating, External, M.D.
PRATT & WHITNEY Contour, Latest
THOMPSON 6" x 48" Auto., Round Broach, M.D.

GRINDERS—Surface

ARTER 30" Rotary Hydraulic, Latest
BLANCHARD #16, 24" Chuck, Motor Drive
BLANCHARD No. 16A—Dial Type—Motor Drive
BLANCHARD #11, 10", Latest Type
BROWN & SHARPE #2, 6"x18", M.D.
DO-ALL 8" x 24" Hyd., Latest Type
HEALD #22 Rotary, 12" Chuck, Latest Type
HEALD 25A—Rotary—16" and 30" Chuck, Hyd., Latest
KENT 6" x 18" Hand, Latest
MATTISON 14x24x72" Hyd., Latest
MATTISON 14x16x60" Hyd., Latest
NORTON 6x18 Hydraulic; Latest Type
PRATT & WHITNEY 8" Rotary, M.D.
THOMPSON 16x30x48 Hydraulic, Latest Type

JIG BORERS

PRATT & WHITNEY 3B, Model 4854, Latest
PRATT & WHITNEY 1A, Motor Drive
REED-PRENTICE #5 Die Sinker, Latest Type
VERNON, Precision, Latest Type

LATHES—Engine and Mfg.

AMERICAN 18 x 72" Centers, Geared, M.D.
AMERICAN 36" x 360" Centers, 2 Carriages, M.D.
BRIDGEFORD 36" x 32' Bed—2 Carriages, M.D.
HENDEY 12 x 54" Centers, M.D.
JONES & LAMSON "Fay" 20 x 25" Automatic, Latest
KEIGHLEY LIFTS 8/16 x 26" Centers Gap, Latest
LeBLOND 20" x 40" Centers, Geared, Motor Drive
LeBLOND 17 x 5', Bed, RP, Timken, Latest
LeBLOND 25 x 96" Centers, Geared, M.D.
LEHMAN 16 x 30" Centers, TIMKEN, Latest Type
LODGE & SHIPLEY 14"x30", 16"x30" Centers, Latest
LODGE & SHIPLEY 18 x 72 Centers, M.D.
LOGAN 10"x24" Centers, Timken, Latest
LoSwing 4x60, 4x48, 8x60, 8x108, 5x34, Latest
MONARCH 12 x 30" Centers; Timken; Latest Type
MONARCH 12" x 54" Centers, Timken, Latest Type
MONARCH 16 x 28" Centers, Geared-Head, M.D.
MONARCH 10"x20" Centers, Model EE, Timken, Latest
MONARCH 22" x 456" Centers, 3 Carriages, Timken Bearing, Motor Drive
MONARCH 24 x 54 Centers, Geared, M.D.
MOREY Model A 8" x 120" Shaft Turner, Latest Type
NILES 26" x 48" Centers, D.C., M.D.
NILES 26" x 72" Centers, D.C., M.D.
NILES 30" x 100" Centers, D.C., M.D.
NILES 42" x 60" Double Head, Motor Drive
NILES 60 x 10', Centers, PRT, Latest Type
NILES 72"x62' Centers, Comb. Boring & Turn, M.D.
NILES 30 x 50' Boring, Timken, Latest Type
NILES 48x87' Centers, Comb. Boring and Turn, M.D.
NILES 90"x110" Centers, Standard Driving Wheels, M.D.
PRATT & WHITNEY 16" x 30" Centers, Latest
PRATT & WHITNEY 10" x 20" Centers Bench, Latest
PUNTNAM 42" x 25' Centers, Motor Drive
REED PRENTICE 16x24" Centers, Geared, M.D.
REED PRENTICE 20" x 54" Centers, Latest
SEBASTIAN 16" x 36" Centers, Type H, Latest
SPRINGFIELD 14" x 6' Bed, Geared Head, M.D.
SPRINGFIELD 16" x 6' Bed, Geared Head, M.D.
SPRINGFIELD 16" x 30" Centers Timken, Latest Type
WARD, HAGGAS & SMITH—18/30 x 66" Centers Gap Motor Drive, Latest Type

LATHES—Turret

BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fastermatic," TIMKEN, Latest
GISHOLT #1L, #2L, Universal, Timken, Latest
GISHOLT #3, #4, Univ., TIMKEN, Latest Type
JONES & LAMSON #3, #5, #8A Univ. Timken, Lat.
LIBBY No. 1H-5 Timken Bearing—latest—5⅛" Hole
MOREY No. 2G, No. 3, No. 4, Timken Bearing, Latest
POTTER & JOHNSTON 5D2E, Auto., Timken, Latest
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #3A Universal Motor Drive
WARNER & SWASEY #1A, Univ., Timken; Latest
WARNER & SWASEY #2A Universal, Timken, Bar & Chucking, Latest Type

MILLING MACHINES—Mfg.

CINCINNATI 24", 48" duplex, TIMKEN, M.D.
HALL Style D, Planetary, Latest Type
INGERSOLL 42"x38"x12' adj. rail, 4 heads, A.C., M.D.
INGERSOLL 32x24x16' Planer Type, 2 heads, AC, M.D
INGERSOLL 32x30x12' Adj. Rail Slab, M.D.
SUNDSTRAND Model 3A Duplex, Latest Type
TAYLOR & FENN M80 Duplex Spline, Latest

MILLING MACHINES—Plain

BRIGGS Type A, Hyd., 12" & 18" Feed, Latest
BROWN & SHARPE #12, 24" Feed, Latest
BROWN & SHARPE 3B, Timken, Latest
BROWN & SHARPE #2 Light, Latest Type
CINCINNATI 0-8 Automatic Rise and Fall, Latest
CINCINNATI 1-12, 2-18 Auto. Latest Type
CINCINNATI #4 TIMKEN, Motor Drive
CINCINNATI 3, 4, 5, Motor Drive
CINCINNATI 24" Automatic, TIMKEN, M.D.
CINCINNATI 4-36 Hydromatic, Latest Type
KEARNEY & TRECKER 1318, TIMKEN, Latest
KEARNEY & TRECKER #3, 4, Heavy, Timken, M.D.
KEMPSMITH #4 Maximiller, Timken, Latest Type
LeBLOND No. 4, Belted Motor Drive
SUNDSTRAND #3, Rigidmil, Timken, M.D.

MILLING MACHINES—Vertical

BRIDGEPORT High Speed, Latest Type
BROWN & SHARPE #5, M.D.
CINCINNATI #2, #3, #4 Dial Type, Timken, Latest
CINCINNATI #08, TIMKEN, Latest Type
COCHRANE & BLY #14, M.D.
GORTON 9J, Hand Feed, Latest Type
KEARNEY & TRECKER 2H, Timken, Latest
MOREY 12M Profiler, Latest Type
REED PRENTICE #5 Die Sinker, Latest Type
REED PRENTICE 3VG, with or without Hydraulic Duplicator, Timken Bearing, Latest Type
SUNDSTRAND #3 Profile & Channel, Latest

MILLING MACHINES—Universal

AMES 2½"x19" Table, Latest Type
CINCINNATI #4, High Power, M.D.
HARDINGE Model UM, Timken, Latest
KEARNEY & TRECKER #2 Heavy, Timken, M.D.
KEMPSMITH #4 Maxi-miller, Timken, Latest
VAN NORMAN #12, Timken, Latest
VAN NORMAN #3, Duplex, M.D.

PLANERS

BETTS 96"x96"x20'—4 Heads, PRT, Box Table, M.D.
CHANDLER 36"x36"x20'—4 Heads, AC, M.D.
CINCINNATI 120"x96"x26'—4 Heads, Box Table, M.D.
CLEVELAND 48"x60"x20'—Openside, 3 Heads, M.D.
DETRICK & HARVEY 48"x48"x16'—4 Heads, Hyd.
GRAY 24"x24"x8' A.C. Motor Drive
GRAY 36"x36"x8'—2 Heads, Max. Service, D.C. Variable, Speed Motor Drive
LIBERTY 24"x24"x8'—Vari-Voltage, Latest Type
NILES 48"x48"x12'—4 Heads, Box Table, DC, M.D.
NILES 54"x54"x18'—4 Heads, Box Table, M.D.
NILES 48"x48"x16'—3 Heads, Box Table, M.D.
WOODWARD & POWELL 54"x54"x20', 4 Hds., M.D.

PRESSES

BIRDSBORO 325 Ton, Vert. Hyd., Latest Type
CHAMBERSBURG 50 Ton, Vert. Hydro-pneumatic
CHAMBERSBURG 200 Ton, Horiz. Straightening, M.D.
CLEARING Type D8-1125-32 Dbl. Action 125 Ton, Latest Type
CLEARING H-50-36 Vertical Hydraulic, Latest Type
FERRACUTE #DG-55, 75 Ton Drawing, Latest Type
GLEASON 15 Ton Quenching, M.D.
HANNIFIN 15 Ton Moulding, Latest Type
HPM 37-Ton Vertical Hydraulic, Latest Type
LAKE ERIE 500 ton Vert., Hyd., Latest
LUCAS 30 Ton Forcing, Latest
WATSON & Stillman 20 Ton Hyd. Straightening, Lat.

SHAPERS & SLOTTERS

CINCINNATI 24" Crank, M.D.
DILL 20"-24" Vertical, Motor Drive
GOULD & EBERHARDT 16" High Duty, M.D.
GOULD & EBERHARDT 32" INVINCIBLE, M.D.
LAMAIRE 18" Vert. Hydraulic, Latest Type
LYND FARQUHAR 26" Openside, M.D.
NEWTON 15" Vert. Slotter, DC, M.D.
NILES 18" Vert. Slotter, DC, M.D.
ORMEROD 8" Vertical, Latest Type
PRATT & WHITNEY 6", 10" Vertical, M.D.
ROCKFORD 21" Universal, Hydraulic, Latest
SMITH & MILLS 16" High Speed, Latest

MISCELLANEOUS

AJAX 1¼", 2", 3½" Forging and Upsetting, M.D.
BAKEWELL #1, #1R Tapper, M.D.
BARNES #172, 306H, 307 Vertical Hone, Hydraulic, Self-Oiling, Latest Type
BILLINGS & SPENCER 1500 lb. Board Drop Hammers
CAMPBELL #401 Abrasive Saw, Latest Type
CLEVELAND 12"x16' Centers—Cutter Reliever, M.D.
FOSTER 4x18 Super Finisher, Hydraulic, Latest
GROB G-8 20 Band Saw, and Filer, Latest
HANSON & WHITNEY 4"x9" Thread, Miller, Latest
LANDIS 1⅛" Bolt Threader, Latest
MICHIGAN #1708 Cutter Reliever, Latest Type
MOREY 12x36", 120", 190" Thread, Miller, Latest
NAZEL #4B Pneumatic Hammer, M.D.
NORTON #2F 10U Vertical Lapper—Latest Type
PORTER CABLE Type AG-8 Sander, Latest Type
PRATT & WHITNEY (KELLER) Type BL-2416 Copying, Latest Type, 2 & 3 Dimensional
PRATT & WHITNEY (KELLER) Type G Copying, Latest Type 2 Dimensional
PRATT & WHITNEY ½Bx50 Rifler, Latest Type
QUICKWORK #6, 1" Cap, Rotary Shear—M.D.
RACINE #30C, 10x10 Hack, Hyd., Latest
RIEHLE 1500 lb. Tester, Latest Type
ROCKWELL Model #3QR Tester, Latest Type
STOEVER 4"-12" Pipe Threader, M.D.
TANNEWITZ GH-36 Band Saw, Latest Type
ULTRA-LAP #7, #10 Surface Lap, Latest

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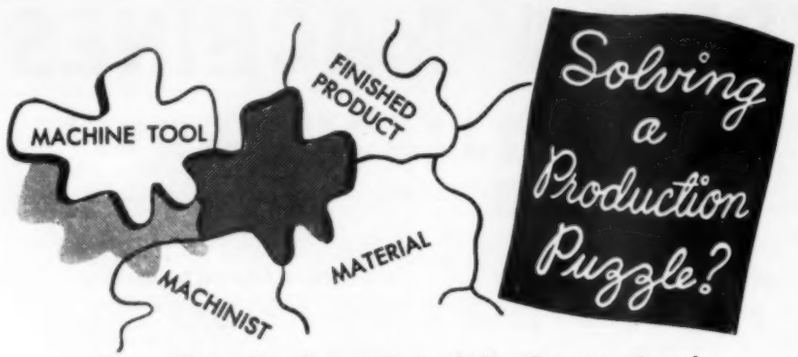

You Can Be Sure Botwinik *Guaranteed* Machine Tools Will Fit *ALL LATE TYPE TOOLS*

GRINDERS

Mattison 14"x24"x60" High Power Hydraulic Precision Horizontal Surface Grinder—complete with magnetic chuck

Pratt & Whitney Type M-1640, 14"x60" Vertical Hydraulic Surface Grinder, MD 30 HP on spindle, segment chuck wheel—complete with 14"x60" magnetic chuck (very late type—equal to new)

Blanchard #11 High Power Rotary Surface Grinder—18" dia. magnetic chuck—range 20" dia. x 8" high over 16" chuck

Brown & Sharpe #2 Universal Grinder, 14"x30" ctrs, with coolant and considerable atchmts.

Norton 12"x36" Multi-purpose Hydraulic Univ. Gridner with internal and external atchmts, chuck, face plate

Norton 10"x18" Type "C" Mechanical Traverse Plain Cylindrical Grinder—complete with 5 motors

LATHES

2—(Brand new) Hendey 14"x30" and 18"x48" GH Motor-In-Base Engine Lathes—12 spdl speeds—atchmts

Pratt & Whitney 20"x48" Ctrs Model "B" 16-speed Engine Lathe—Motor-In-Base—Hole thru spdl 2"—Actual swing 21¼"—16 Spdl Spds 8 to 383 RPM—Taper attachment

Pratt & Whitney 18"x36" Model B Grd Head Motor-In-Base Engine Lathe, swing over ways 18½", dist. between ctrs 36", hole thru spdl 1-11/16", 8 Spdl Spds 7-440 RPM

Bridgefort 36"x56', 15 speed geared head Engine Lathe—MD, AC electrical equip—power rapid trav. to carr.—compound rest—2 steady rests—swing 38" over bed, 26" over carr.—dist. between ctrs. 48"—motorized apron and taper atchmts

TURRET LATHES

WARNER & SWASEY #4 & #5 Pre-Selector Head Universal Turret Lathe—Holes thru spindles 2-7/16" and 2⅞"—swing 18⅛" and 20"—Bar & Chucking

Foster #5 Univ. Ram Type Turret Lathe, latest type, AC motor driven, swing over bed 17½", hole thru spdl 2⅝", bar feed & chuck equip., consid. extra tooling

VERTICAL MILLERS

Reed-Prentice #4 Improved Hydraulic Vertical Milling Machine (1942 vintage) complete with Detroit duplication atchmt—Tbl Wkg Surf 70"x24", Range long 48", cross slide travel 24", vertical travel head 12"—top of Tbl to Spdl Nose max. 24", min. 12"—power rapid traverse—#50 Taper—18 Spdl Spds 30 to 1200 RPM—weight 18,000#

Brown & Sharpe #2 Light Type Vertical Miller (late type)—Tbl Wkg Surface 45"x10", range long 28", cross 10", vert 14", Spdl Spds 16, range 55 to 1800 RPM—power rapid traverse

Milwaukee #2KM Vertical Milling Mach. (latest type) with Rotary Table—Tbl Wkg Surf 56"x12"—range long 28", vert 14", cross 12", Spdl Spds 24, range 15 to 750 RPM

Milwaukee #4H Vertical Miller (late type) Tbl Wkg Surf 74"x15½"—16 Spindle Speeds 20 to 1000 RPM

HORIZONTAL BORING MILLS

Baush 4" Hydraulic Horizontal Boring, Drilling and Milling Machine (late type) dia. Spdl 4", vert. travel spdl head 48", wkg surf tbl 48"x96"—feed & power rapid traverse hydraulically driven

Yoder #3A Horizontal, late type, 3" bar, max dist to outer support 72", bar travel 24"

PRODUCTION MILLERS

2—B & S #12 Pl. Mill. Mchs, motor driven, Tbl Wkg Surf 48⅝"x12"—feeds long 18", cross adj. of spin 3¼", vert adj. of spin hed. 10½"—#50 Taper—electrically controlled, very latest type

Cin. #4-36 Plain Hydromatic Miller—Motor in base—(late type)—Tbl Wkg Surf 53½"x16"—long feed 36"—automatic intermittent feed—power quick traverse

Cin. #5-60 Duplex Tracer-controlled Hyd. Miller, Tbl Wkg Surf 20"x78½", cross range left hand quill 8", right hand quill 8", vert movement of spindle, tracer or manual control 13¼", very latest type

HAMMERS (Board Drop)

1—Billings & Spencer 800#
2—Chambersburg 2500#
1—United 3000#
1—Chambersburg 4000#

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Botwinik Brothers of Mass., Inc.

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SLAB MILL 24" ROLLER TYPE 75 HP MD.
EX-CELLO MODEL 33, EX. THREAD GRINDERS
NORTON PLAIN EX. GRINDER 18"x36"
RIVETT #103 INTERNAL GRINDER
LEES BRADNER CT THREAD MILLERS 36"
GEAR HOBBER G&E 6'x12"
GEAR HOBBER B&S #4—36"
GEAR SHAPER, FELLOWS MODEL 615
FARNHAM FORMING ROLLS 12' & 15'
ONSRUD ROUTER, MODEL A-4-RR 84

CONTINENTAL SALVAGE & MACHINERY CORPORATION

1836 EUCLID AVENUE, CLEVELAND 15, OHIO
MAIN 4402

National Bent Shank Nut Tappers Battery of ⅝" to 1" Machines.

Waterbury-Farrel Fdry. ⅝" and 1" D.S. S.D. Cold Headers, also Thread Rollers.

Fisher 5" Bar, Floor Type Boring Mill. New in 1942.

Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.

Bliss Presses in all sizes up to 1,000 ton capacity.

Wire Working Machinery.

National Machinery Exchange

128-138 Mott St., New York 13, N.Y.

AUTOMATICS

No. 0G Brown & Sharpe
8" Bullard Multaumatic
1⅞" Conomatic 8 spindle
14"x19" & 16"x33" Fay
Gisholt Simplimatic
1¼" Cleveland 4 spindle

BORING MACHINERY

4" bar, No. 42 Lucas horizontal
3" bar Universal horizontal
100" Niles-Bement-Pond, heavy pattern
53" Niles Bement Pond

DRILLS

21" & 24" Cincinnati upright
Nos. 121, 217, 314 & 315 Baker heavy
6', 15" Cint. Bickford radial
24", 6 spindle Foote Burt sensitive
4' Hammond Elbow Arm Radials
B4A—24 spindle Natco
24", 4 spindle Allen & Demco
12", 4 spindle Avey No. ½
15", 3 spindle Avey Type MA6

GEAR MACHINERY

No. 50 Cross Tooth Thinner
8H, 12H & 16HS Gould & Eberhardt
No. 12 Barber Coleman
No. 5M Adams Hobber
No. 4 Cimatool Rounders
No. 130 Cleveland Rigidhobber

GRINDERS, CYLINDRICAL

4"x12" No. 4H Landis
6"x18" Norton, Landis, & Brown & Sharpe
Nos. 1, 2, & 13 Brown & Sharpe Universal
10"x18", 10"x30", & 10"x50" Norton mechanical
10"x18" Landis Type C, Hyd.
10"x24" & 16"x72" Landis Mechanical
14"x36" Landis Type C, Hyd.
16"x36" Landis Type D, Semi-Auto. Hyd.

GRINDERS, SURFACE

16" No. 10 Blanchard Rotary
30" No. 16 Blanchard Rotary
12" & 16" No. 22 Heald Rotary
16" & 24" No. 25A Heald Rotary
8" Pratt & Whitney Rotary
10"x24" Norton Hydraulic
12"x48" Thompson Hydraulic
14"x60" Mattison Hydraulic
14"x40" Pratt & Whitney Vertical
8"x22" Abrasive No. 3
8"x24" Abrasive No. 34 Vertical
24"x48" Springfield Planer Type
6"x18" #2 Brown & Sharpe

LATHES ENGINE

14"x6' Lodge & Shipley
14"x8' American
15"x6' Porter McLeod
16"x30" centers Monarch
18"x8' Lodge & Shipley
36"x16' Bridgeford

LATHES TURRET

24" & 42" Bullard
Nos. 4, 1L & 3AL Gisholt
Nos. 3, 5, 1A, & 3A Warner & Swasey
No. 3 Jones & Lamson
No. 2F Foster Fastermatic

MILLING MACHINES

Nos. 2H, 3H, & 4H Kearney & Trecker Vertical
Nos. 2, 3, & 4 Cincinnati Vertical
Nos. 1, & 1M Kent Owens Hand
Nos. 1-12, 2-18, & 2-24 Cincinnati Automatic
Nos. 2-18 & 2-24 Cincinnati Rise & Fall Automatic
Nos. 3-24, 4-36, 4-48, 5-48, 34-36, 36-72, & 58-90 Cincinnati Hydromatic
Nos. M-18, M-24, & 12-24 Kearney & Trecker

PRESSES

Nos. P1, P2, P3, P4 & P5 Ferracute punching
Nos. 10, 73½, 75½, 304 & 307 Bliss S.S.
No. 1½ Bliss cam drawing
200 ton & 1000 ton French Oil Hyd.
No. 2316½ Hamilton coiner
500 ton No. 2 National Maxi-press

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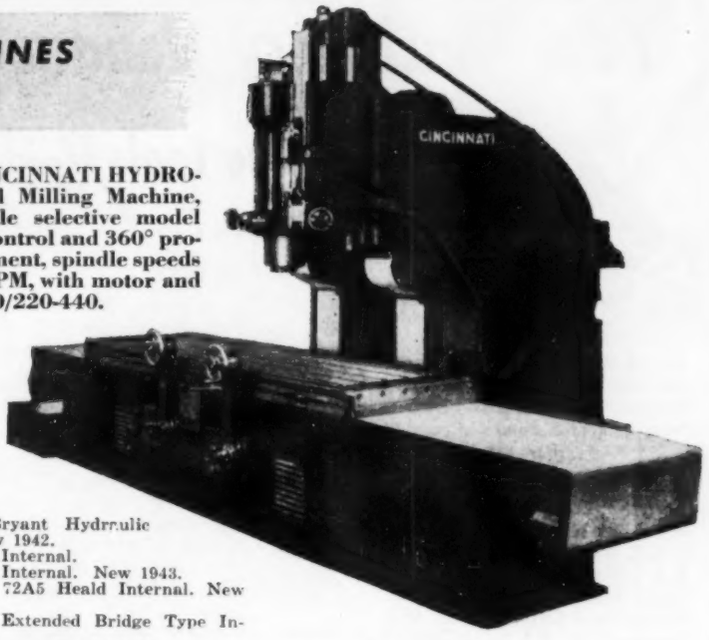

28" x 60" CINCINNATI HYDROTEL Vertical Milling Machine, single spindle selective model with depth control and 360° profiling attachment, spindle speeds 30 to 750 RPM, with motor and controls 3/60/220-440.

AUTOMATICS

9/16" and 1" RA-6 Acme-Gridley. New 1943.
1⅝" 6 Spindle Greenlee. New 1942.
6" 4 Spindle Conomatic. New 1942.
6" Goss and DeLeeuw Chucking Machine—eight spindle. New 1943.
★**Bullard Multaumatic, six spindle model D, single index. Late Model.**

BORING MILLS

★**Universal No. 40 Tri-Way, 4" bar, with facing head rotary table, boring bar, motor and control.**
Heald No. 49 "Bore-Matic," three spindles each end. New 1942.
Heald No. 47A "Bore-Matic."
Heald No. 46B "Bore-Matic."
Excello Model 2112A, single end. New 1943.

BROACHES

No. CPC 6-30 LaPointe Hydraulic Vertical. New 1941.
LaPointe Universal Broach Grinder.

DRILLS

6' Carlton Radial, 17" column.
3' Cincinnati Bickford Radial, 9" column. New 1943.
3' and 4' Dreses Radial, 11" column enclosed head, motor on arm, 1938 model.
2' Pfeffner Jack Knife Radial.
24" Sibley Sliding Head.
25" Fosdick Economax. Late model.
No. H3 Barnes Hydram, 8 speed. New 1942.
36 HO Baker. New 1942.
KH 2 Allen, 6 spindle. New 1943.
★**No. 2 MS Allen, one to three spindle, four speed motor on each spindle, 15" overhang, extra large tables.**
Demco 3 spindle.
Hamilton-Muehlmat.
No. 3 Bausch Multiple Spindle.
Barnes Horizontal Deep Hole, two spindle.

GEAR CUTTERS

No. 7A & 715 Fellows Gear Shaper.
No. 615A Fellows Gear Shaper.
Red Ring Gear Shaper, Model G.C.L.
No. 12 Barber Colman Hobber
Model S Barber Colman Hobber.
Barber Colman Hob and Cutter Grinder.

GRINDERS

No. TG 615 Jones & Lamson Thread. New 1943.
No. 2 Cincinnati Centerless, Filmatic. New 1942.
★**No. 2 Cincinnati Universal Tool & Cutter complete. New 1942.**
No. 4T Sellers Tool.
No. 22 Covel Universal Tool & Cutter. New 1943.
No. 13 Brown & Sharpe Universal and Tool.
No. 3 Brown & Sharpe Universal. New 1943.
10" x 24" Landis Universal. New 1942.
14" x 36" Norton Universal.
4" x 18" Landis, Type H.
6" x 18" Cincinnati, Filmatic Bearing.
6" x 18" Norton Type C. New 1942.
10" x 48" Norton Type "C."
No. 22 Heald Rotary Surface. New 1943.
No. 18 Blanchard, 30" chuck. New 1942.
16" x 16" x 48" Thompson Model C. Surface.
3B Abrasive, with chuck. New 1943.
No. 5 Brown & Sharpe Surface. New 1942.
No. 15 & No. 18 Gallmeyer Livingstone Surface.
6" x 12" x 18" Thompson Surface. New 1942.
No. 2B Reid Surface, for wet grinding.
No. 16CP16 Bryant Hydraulic Internal. New 1942.
No. 104 Rivett Internal.
No. 75A Heald Internal. New 1943.
No. 72A3 and 72A5 Heald Internal. New 1943.
No. 74 Heald Extended Bridge Type Internal.

LATHES, ENGINE

Hendey 12" x 30", g.h.
Reed Prentice, 14" x 30", g.h.
Lodge & Shipley Tool Room, 14" x 54", rel. att. New 1943.
Reed Prentice, 14" x 78", Toolroom. New 1943.
American Pacemaker, 16" x 30". New 1942.
Reed Prentice, 16" x 54". New 1943.
Sidney 18" x 54". New 1943.
Lodge & Shipley 20" x 48". New 1943.
28" x 34' "Timesaver," g.h. New 1942.
Lodge & Shipley 48" x 54", C.D.
Carroll Jamieson, 18" x 5', C.D.
South Bend, 14½" x 6' New 1944.
Lo-Swing, models IMP and R.
8" x 15" and 8" x 21" Sundstrand Automatic. New 1943.
8" x 21" Faye Automatic. New 1943.
14" x 42" Monarch "Magnomatic." New 1942.

LATHES, TURRET

Warner & Swasey No. 4A, with chuck, 7½" hole.
★**Warner & Swasey No. 2A. New 1943.**
Jones & Lamson No. 9A. New 1943.
Gisholt No. 3L. Late Model.
Acme No. 1 Universal, saddle type. New 1941.
Bardons & Oliver No. 7 Ram Type, Bar Feed and Tooling. New 1942.
Gisholt No. 4 Universal, Hydraulic speed selector.
Warner & Swasey No. 5 Universal. New 1941.
Warner & Swasey No. 4 Universal. New 1941.
Warner & Swasey No. 3 Universal. New 1942.
Bardons & Oliver No. 3 Universal, motor in base. New 1941.
Warner & Swasey No. 2. New 1942.
Bardons & Oliver No. 2, bar feed. New 1941.

MILLS

Milwaukee No. 2D Vertical, Rotary Head. New 1945.
Milwaukee No. 2H Universal. New 1942.
Cincinnati No. 2M Universal.
Brown & Sharpe No. 2A Universal. Late type.
Kempsmith Maximiller Plain, No. 3.
Brown & Sharpe No. 3B Plain. New 1943.
Brown & Sharpe No. 2B Plain.
Cincinnati No 2M Plain.
Milwaukee No. 3H Vertical, latest model.
Cincinnati No. 2 Vertical. New 1940.
Index No. 40H Vertical.
Cincinnati Plain No. 08 and 2-18, Rise and Fall.
Cincinnati No. 1-12 and 1-18 Automatic.
Cincinnati No. 3-36 Hydromatic.
Cincinnati No. 34-36 Hydromatic High column with Hydrotel.
Milwaukee No. 1248 Simplex.
DeVlieg Supermill, No. 31B.
Brown & Sharpe No. 12. New 1942.
Kent Owens No. 1-14.
Whitney Hand Mill, No. 6.
VanNorman Hand Miller. New 1942.

MISCELLANEOUS

Grey Nibbler, 36" throat, ¼" capacity.
Savage Nibbler, 8" throat, 3/16" capacity.
Cleveland Rigidturner, No. 616.
14" x 20" Racine Hydraulic Saw.
13" x 13" Peerless High Speed Saw.
No. 26F Norton Hydrolap.
No. 8-6 Zeh & Hanneman S.S. Geared Press.
Toledo No. 41 Horn Press.
Williams White No. 14½ Punch, 1" through 1".
Tapper, Leland Gifford 3' Radial, No. 3 M.T. New 1941.
Parker Tube Bender, No. 824G.
Schauer & Colbourne Speed Lathe.
5 H.P. L'Hommedieu Buffer.
5 H.P. Clark Buffer.
18" Gardner Disc Grinder.
Lanfelier Type D Swager.

PLANERS & SHAPERS

Ohio Planer, 36" x 36" x 16' M.D.
Cincinnati Planer, 42" x 42" x 20', Four heads D.C.
Cincinnati Planer, 52" x 36" x 40', Four heads. Box table D.C. motor drive.
Gould & Eberhardt 16" Shaper.
American 24" Shaper.
Smith & Mills 28" Shaper.
Pratt & Whitney 6" Vertical Shaper. New 1943.

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Avey & Allen 3, 4, 5, & 6 Spindles
Fox M.D. Type 138C Multi Spld. Late
Cincinnati-Bickford 3', 4', 5', & 6' Radials
Niles-Bement & Pond 6' Radial

GRINDERS

Norton 6"x10"x36" Surface
Norton 15"x17"x72" Surface
Hill-Acme 18"x96"x24" Surface
B. & S. Nos. 1, 2, 3, 4 Universal
B. & S. Nos. 5 & 11 Plain
Bryant Nos. 3B, 6 & 12 Internal
Norton No. 2 Cutter & Tool, M.D.
Cincinnati No. 2 & No. 3 Centerless
Cincinnati No. 3 Centerless Lapper
B. & S. No. 13 Univ. & Tool, Late Type
Blanchard No. 16—26" & 16A
Blanchard No. 16—30 Vert. Late
Heald No. 25-A 16" Rotary Surface
Heald No. 22—12" Rotary Surface
Abrasive Nos. 33, 3 & 34 Surface
Heald Nos. 70A & 72A Internal
P. & W. 14" Vert. B. B., M.D.
Norton Type "C" 6"x18" M.D. Hyd. Cyl.
Norton 10"x24" M.D. Plain Cyl.
Pratt & Whitney 9" M.D. Hyd. Gear
Thompson Model BB & B Hyd. Surface

LATHES

Johnson 36"x36' B.G.L.C.G. Engine
Monarch 12"x30" CK (swings 18")
Hendey Plain 12", 14", 16", 18" Yoke Head
Hendey 12"x5' Y. H. Fact. M.D.
Hendey 24"x8' M.D. Q.C.G. Eng.
Hendey 12"x5' M.D. Geared Head
Amer. 18"x12' B.G. M.D. Engine
American 30"x16' G. H.M.D. O.C.G. Eng.

MILLERS

Milw. No. 1½B Univ. M.D.
Cin. No. 2 Univ.
K. & T. No. 2HL, No. 4H Plain
Milw. No. 3B Univ. D.O.
B. & S. No. OY Production
B. & S. No. 3A Universal
Cin. Nos. 2 & 3 Vert.
Van Norman No. 3SP Plain
Becker Model C Vertical
B. & S. Nos. 3B Plain
Van Norman Nos. 0, 10 & 11 Duplex
P. & W. 8", 10" & 12" Auto.
Cincinnati 18" & 24" Production
P. & W. 6"x80" M.D. Thread
P. & W. 6"x14" Int. Thread
Cinn. No. 3 M.D. Plain
Milw. No. 1H-12 Mfg.
Potter & Johnston 2M Horiz. Auto.
Gorton No. 9J Vert. Late
B. & S No. 21 Plain Auto.
Kempsmith No. 2G Plain Late
Kempsmith No. 4, Plain Max. Late
LeBlond 3GH Plain Heavy

SHAPERS

Cincinnati 24" M.D. Crank Late
Hendey 32" M.D. Crank Late
Gould & Eberhardt 24" Crank
Gould & Eberhardt 16" M.D. Crank

PRESSES

W. F No. 6 Knuckle Joint Coining
Bliss No. 304 M.D. S.S. Single Crank
Toledo 34P, M.D. Punch
Bliss No. 21 O.B.I. Power
W. F. No. 7 O.B. Dial Feed

SCREW MACHINES

B. & S. No. 00, 0, 2 Automatic
B. & S. Nos. 1 & 2 Hand
Gridley ⅞", 1¼", 1¾" & 2⅝" Model G
Cone 1¼", 3¼", 3½" & 4¾"—4 Spindle
Simmons No. 2 Micro-Speed
Foster No. 7 & 7B
W. & S. Nos. 1, 2, 2A, 3A Univ.

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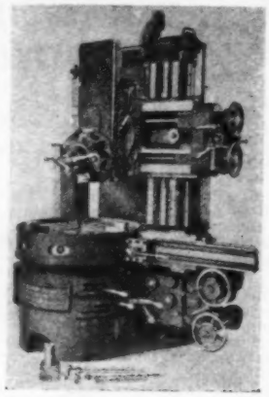

Niles Tool Works 38"—44" Vertical Turret Lathe—Heavy Duty—Power Rapid Traverse—Motor driven with A.C. motor—Large quantity of tooling—Excellent Condition—

¾" Landis Automatic Combined Pointing & Threading Machine—new 1942—equipped with Automatic Stud Feeding attachment—excellent shape.

BOLT AND NUT MACHINERY

1—No. 0 AJAX. 5/16" cap. Wire Drawing Att. New in 1944.
1—No. 500C MANVILLE High Speed Trimmer, Cap. ½"x4½".
1—No. 625C MANVILLE High Speed Trimmer, Cap. ⅝"x6".
1—No. 1 MANVILLE ¼" D.S.S.D. Cold Header geared, motor drive.
2—No. 2C MANVILLE ¼" Screw Slotters, all
2—Kingsbury 4 spdle—semi-automatic Vertical Pin Drilling Machines. New in 1942. Complete with burring attachments ⅞" dia. cap. Production up to 2000 pieces per hour.
1—1" AJAX Hot Bolt Header and Upsetter, rivet att.
1—No. 2 MANVILLE, D.S.O.D. Cold Header, cap 5/16"x6"

MACHINE TOOLS

1—No. 3B ABRASIVE, 8"x24" Surface Grinder, New in 1941, with magnetic chuck and motor.
1—LASALLE 6"x24" Surface Grinder, new in 1946 with Permay chuck and motor.

MISCELLANEOUS

1—BUFFALO cold rolling Mill. 4"x6½" rolls.
1—CLEVELAND "C" S.E. Punch and Shear, cap. 13/16"x3¼" arch jaw, 30" throat, motor driven, with motor.
1—KALAMAZOO Metal Band Saw, cap 8"x16". Late model.
1—PAASCHE Water Wash Paint Spray Booth.

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EXCEPTIONAL BUYS—CLEAN TOOLS

No. 4 W-S Turret, Bar feed, quantity of tooling 412,000 plus
6 spindle drill press (Demco) Late
No. 4 Cinn. H.S. Dial Type Vert. Miller Like New
P. W. Keller Machine Like New
Haskins and Bakewell Tappers Late
Lees Bradner Thread Miller (Cheap)
2-TR-59 Hardinge Lathes Late
Vernon Jig Borer Late
Model EE 10" Monarch Complete, Like New
#4 Cinn. Horizontal Mill Cheap

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IMMEDIATE DELIVERY FROM STOCK

BULLARD 24" New Era Vertical Turret Lathe, 3-jaw Combination Chuck, MD

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NATCO No. 14 Multiple Spindle Drill Arranged for 18 Spindles, 2-speed Head Motor Driven

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Pratt & Whitney BG1 Keller Die Sinker
Bullard 36" Vertical Boring Mill
Defiance 6" Horizontal Table Type Boring Mill
Betts 6" Floor Type Boring Mill
Reed-Prentice #5 Die Sinker
Fosdick #30A Jig Borer
Blanchard #11 Rotary Surface Grinder
Blanchard 24" Rotary Surface Grinder
Cincinnati-Bickford 6 x 17" High Column Radial
Cincinnati #4 H.S. Dial Type Horizontal Mill
Morey 14" Vertical Shaper

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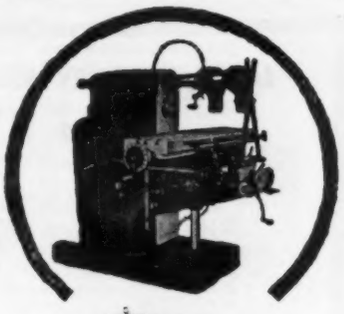
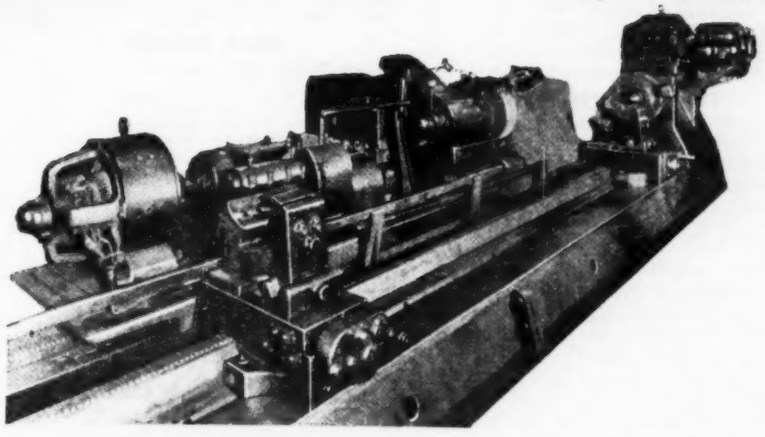


SCARCE LATE MACHINES

B & S 00G Automatics (3)
Van Norman #12, Slotter, etc.
Canedy-Otto 3'9" Col. Radial
Consomatics 6 spdl. 2⅞", 1⅛" late, fully equipped.
NBP 2500 lb. Single Frame Steam Hammer
Ferracute D.D.G. 56, 100 ton Double Action Cam Press.
Universal 3" boring mill
Gorton Duplicators and Vert. Millers, 6D, 9J
Gorton No. 30, 3Z, Engravers
Marvel No. 6 Hacksaw, M.D.
Injection Moulders, Hydraulic Presses
Thompson 6 x 18" Hyd. Surf. Grinder, Type C & F
Abrasive 6x18, 8x24 Surface Grinders No. 3B, 34, 1½
Consomatic 1⅞" 6 spindle
Brown & Sharpe #5 Cyl. Grinder
Tannewitz Band Saw #36M
Thompson Sclaky Seam, Spot Welder
Gisholt No. 4, 5, Univ. Turrets
W & S Nos. 3, 4 Grd. Hd. Pre-selector
Gisholt No. 1, 5, Univ. Turrets
Acme #6W M.D., Foster 3B
Oliver 20" Woodworking Planer
Oster 601 Rapidustion, Tooling
Hardinge ESM, 2nd operation
Cincinnati 12x46" Univ. Grinder
No. 18, 25 and 35 Gallmeyer and Livingston Hyd. Surface Grinders, 6x18, 8x24
#25A Heald, M.D., Rotary Surf.
Cinn. #2 Centerless Grinders Filmatic, Feeds
B & S No. 2, 2B Surface, M.D.
Norton 6x18" Hyd. Surface, M.D.
Covel #81A Tool, & Cutter
Hammond & Excello Carbide Grind
Gardner #226 Disc Grinder
Monarch 12"x30", 10"x20" Lathe
Hendey 12x36, G. H. Lathes
Morey No. 3 Univ. Turret Lathe
South Bend, M.D. 9x3½", 16x48', 13"x5'
Sebastian 12"x4' grd. hd.
Rivett No. 818 bench M.D.
Hardinge, Elgin Cabinet Lathe
Lodge & Shipley 19"x78" 12 speed Grd. Hd. lathe
Buffalo #0 Angle Roll, Excelsior
Bliss #58.0B Gap Presses 62, 62A, 162
Burke Miller Pl. & Univ.
Nichols Hand Miller, Vert. Hd.
Delta Single & Multiple Drills
Oliver Heavy die Filer, 810
Drill Pointer, Sellers 40
Taylor Winfield 50 KVA Spot Welder
Peerless No. 226, Eyeletting
Hi Speed Hammers, all sizes
Cinn. #3 Pl., #4 Vert. Dial Type, Rect. Arm, Mills
B. & S. #12 Elec. Prod. #21 #000
Waterbury-Farrell #30 Thread Roller & Dies, 1943
Cinn. Bickford 24" Super Serv.
V & O 102 Reducing Press
V & O, Z & H 25, 55, 75 Ton OBI
Cinn. 1-12, 2-18 Production Mills
Stokes Tablet Presses
Ball & Jewel Plastic Grinders
20"x36" Boye & Emmes Grd. Hd., Lathe
Onsrud Router W240
Micromatic Hydrohoner H1
Walker-Turner Bench Drills, ½
Porter-Cable G8 Belt Sander
Le Blond 19"x12 cc. Lathe, Removable cap
Wilder Optical Comparator
Black Diamond Drill Grinder
Cinn. & Schauer Speed Lathes
Cleveland #1 Vertical Miller
Rockwell, Clark Hardness Testers
Bakewell #1, Ultromat Tappers
Federal #5 OBI Press
Gen. Flexible Elec. Screw Press



NORTON ROLL GRINDER 50"x28' M.D., actual swing 54". Bed in two sections. *IMMEDIATE DELIVERY.*

NEW IN STOCK

Power Foot & Gap Shears—30" to 96"
Spot & Arc Welders, 6x6" Racine Hacksaw
4, 5, 7, 10, 12, 18 & 30 ton OBI Power Presses
Ammco 7", Shaps Rite 8", Shapers
H.S. Vertical Milling Heads
Drill Presses, Foot Presses
Kalamazoo Metal Band Saws
No. 1½ Abrasive Wet Surface Grinder
20 ton Northern Hydraulic Presses
0Z & 20Z Injection Moulders
Fameo 6C Arbor Presses—½ Price—Presses
Sheldon 12" B.G. Shaper

TURRET LATHES

Foster Nos. 4, 5, 6, 18, 3B, M.D. Univ.
J. & L. 2"x24", 3"x36"
W&S #4, 2A

GRINDERS

Surface Grinders, 6x18, 8x24, Abrasive, G. & L.
P. & W. 14", B.B., Vert. Surface 19"x49"
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D. Cyl.
Heald No. 72A3 Gagematic
Norton 50"x28' M.D. Roll Grinder
Landis Type A 6x20" Hydraulic, M.D. Cyl.
No. 55, 60, 65 Heald Int., M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 10, 11, Cyl.: 1, 3 Univ.

LATHES

26x12' Boye & Emmes 3 step cone D.B.G.
14"x6' Hendey Taper, Collets 10"x8'
9" LeBlond P&W 1"x15" Automatic
36x30' Putnam M.D., 36x22', 42x16
32"x35' Wickes, M.D.
Wade, Hjorth, Hardinge, P & W Precision Bench

AUTOMATICS

Cleveland Model A ⅞", 1¼", 2"; B 1", 2", ⅞"
Cone 4 spindle, Gridley
Brown & Sharpe #4, 6 Auto., #2 Hand Screw

MISCELLANEOUS

Buffalo 25UD Comb. Punch-Shear
Pexto 3' to 8' Shears & Brakes
Gorton 1A; 375-2 Tool & Cutter Grinders
Wiedman Turret Punch—Type R4P
6" Vertical Shaper, P & W
10x10 Peerless Universal Shaping Saw
#7, 72 Follows Gear Shapers

HYDRAULIC EQUIPMENT

500 TON LAKE ERIE PRESS

Platen 35"x36", 36" stroke, 68" opening, 150 H.P., 220-440 V. Motor.

350 TON VERSON PRESS

40x40 platen, 36" stroke, 72" opening, 100 H.P. 3 phase—60 cycle 440 volt.

400 & 500 TON SHAFT STRAIGHTENERS, Self Contained

All Hydraulic equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your hydraulic problems.

Deckel G1, G2, G1F Engraving machine
Hanson Whitney Thread Miller, Planetary
Leland-Gifford 1, 2 & 4 spindles, Model MS
Geo Ohl 8' 16 Gage M.D. Shear, 12' 10 Ga. Brake
Oster No. 316 6" Pipe Threader, M.D.
Bliss 30" Gang Slitter, 19, 20, 21 OBI Presses

MILLING MACHINES

Milwaukee No. 2, Motor in Base
3B K. & T. Dbl. Overarm
Cleveland Vert. No. 1 M.D.; #1 Univ.
#2B K. & T. Univ.; No. 2, 2A B & S Univ.
No. 3S Cincinnati, S.P.D. rapid trav.
Nos. 1½, 2, 5 B & S Plain & Univ.
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 2, 3, 4 Cincinnati Vert.
P. & W. No. 12, 1 & 2 spind. Profiler
B. & S. No. 1, 3 Vert.
Taylor-Fenn Spline Miller

RADIALS

Carlton 8' Arm 19" col. M.D., 3½' Mueller
4', 5', 6' American Triple Purpose
Walker-Turner ½" cap., 6' Cinn. Bickford

BORING MILLS

#0 Giddings & Lewis arr. M.D. 3"
2½" Cleveland arr. M.D., 2½", 4" Bisaco
Niles-Bement-Pond 4- duplex, 66" Niles
Bullard New Era 24", 42", King 42"

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LATHES

SOUTH BEND, 14"x8', 16"x10', 10"x3½'
BRADFORD, 14"x6', 16"x6', 16"x8'
CLAUSING, 12"x5' M.D.
HENDEY, 16"x8', 16"x8', taper attach.
RIVETT, No. 608 taper attach. precision
LE BLOND 24"x15', M.D.
BRIDGEFORD, 26"x34"x17', taper attach.
LE BLOND 'REGAL', 13"x5', 17"x6', 17x9'
HARDINGE, 1" cap. second operation
ELGIN & HARING PRECISION, 1" cap.
PRATT & WHITNEY, 10"x20", precision
PRATT & WHITNEY, 13"x6', taper attach.
SIDNEY, 18"x10', taper attach.
Monarch Toolroom Model "EE" 10"x20"
Monarch Toolroom 16"x30" Model "C"
Monarch Toolroom 18"x54" Model "C"
Greaves-Klusman 38"x72" Centers, G.H.

TURRET LATHES

WARNER & SWASEY #5 Universal, Preselector
MOREY #3 Universal, Bar & chucking (1945)
GISHOLT, #3 bar equip, preselector, #5, #1L
WARNER & SWASEY, #1A chucking
FOSTER, #5 universal, bar feed
SIMMONS MICRO-SPEED, 1¼" cap, bar feed
WARNER & SWASEY #1, ⅝" cap.
BROWN & SHARPE, hand screw, #0, #1
Jones & Lamson No. 5, No. 9A, preselector

GRINDERS

BROWN & SHARPE #2 Universal, #13
NORTON #2 Universal Hydraulic Tool & Cutter
COVEL, #91A, tool & cutter universal
CINCINNATI, #2 centerless, Filmatic
LANDIS, cylindrical, type H, 4"x12"
CINCINNATI, cylindrical, 6"x18", FILMATIC, HYD.
HEALD, #72A3, plain internal, HYD.
BLANCHARD, VERTICAL SURFACE, #16, 26"
BLANCHARD, VERTICAL SURFACE, #11, 16"
ABRASIVE, VERTICAL SURFACE, #33, 8x24"
MATTISON, SURFACE, 14"x16"x60", hyd.
BROWN & SHARPE, #5 surface, hyd.
THOMPSON, SURFACE, 6"x18", hyd.
BROWN & SHARPE, SURFACE, #2B
REID, SURFACE, #B, Pope spindle
Excello Thread Grinder #31
Jones & Lamson Thread Grinder, 12"x45"
Do-All Hyd. Surface Grinder 6"x18"
Cincinnati Universal Grinder 12"x36"
Wicaco Precision Internal

SHAPERS

Cincinnati 24" latest heavy duty
American 21" M.D.
Gould & Eberhardt, 16", 20" Industrial
Stockbridge, 16", M.D.
Pratt & Whitney, Vertical 6", M.D.
Atlas on steel bench 7", M.D.
Shaperite floor model 8" NEW

DRILL PRESSES

American Radial, 4'x11" column
Avey, 2sp. #MA6, #3 taper
Avey, #2 single spindle, 15" overhang
Leland-Gifford, #2, single spindle
Allen, 6 spindle, #1, 12" overhang
Champion 24", backgeared, #4 taper
Natco, multi-spindle, #D5
Canady-Otto drills 4sp. NEW
Canady-Otto, 17" Roller bearing
Cleerman Box Column

PLAIN MILLERS UNIVERSAL

AMES, UNIVERSAL, PRECISION, BENCH
BROWN & SHARPE, #3A, UNIVERSAL
BROWN & SHARPE, #3B, PLAIN
BROWN & SHARPE, #3, UNIVERSAL
CINCINNATI, #2MH, Universal
KEARNEY & TRECKER, #1B, S.P.
BROWN & SHARPE #2 Light Type, Vertical Head
Milwaukee Universal No. 2HL
Milwaukee Plain No. 2H

VERTICAL MILLERS

CINCINNATI, #3, #4, dial type
VAN NORMAN, #3V, rapid traverse
KEARNEY & TRECKER, #2KM, dial type
KEARNEY & TRECKER, #3KM, dial type
KEARNEY & TRECKER, #3H, dial type
BRIDGEPORT, Cleerman Jig Borer No. 1836

PRODUCTION MILLERS

WALTHAM thread miller, ext. & int.
CINCINNATI, #4-48 hydromatic
CINCINNATI, #1-12 automatic
KEARNEY & TRECKER, #1H-18 Mfg. type
SUNSTRAND, #2 Electromill, 24" travel
BROWN & SHARPE, #000, high speed

GEAR MACHINERY

BARBER-COLMAN MODEL, #3
HAMILTON, SWISS-TYPE, #1 hobber
FELLOWS #61A, Model—712
GLEASON, 18" cap. straight bevel
GOULD & EBERHARDT, #735, spur gears

AUTOMATIC SCREW MACHINES

BROWN & SHARPE, #0G, ⅝" cap.
BROWN & SHARPE, #2, high speed
BROWN & SHARPE, #2, with slotter
BROWN & SHARPE, #00, high speed ⅝" cap.
New Britain, #61, 2¼" cap.

BOREMATICS AND BORING MILLS

Defiance #25A Horizontal 3¾" Bar
Bullard, Spiral Drive Vertical Turret 42"
Excello #2112A, double head
Heald #48A, single head, #49, 4 heads
Heald Bore-matic No. 49, 4 heads
Lucas No. 41, 3" cap. extra long table

PRESSES, SHEARS, BRAKES

Niagara 6'x10 gage, 16" gap
Verson 6'x45 ton cap. press brake
Famco Shears, 36", 52" NEW
Ferracute Press #C3, inclinable
Double Crank Press, 40 ton cap.
Zeh & Hahnemann, 10 ton roll feed
Erie hydraulic 750 ton like new
Diebel Hi-speed and roll feed
Hydraulic Press 25 ton to 750 ton

MISCELLANEOUS

Riveting Hammers, high speed, #5A
Spot Welders 5 KVA to 100 KVA
Famco Foot Presses, #6, #8, #10, #12, #15
BUTTERFLY Filing machines
Porter Cable belt sanders
Lake Erie Hydraulic Press 750 Ton

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MONA MEMBER

PRESSES

375 ton Elmes, 12" stroke, 84x54 bed, late type
350 ton Elmes, 20" stroke, 36x45 bed, late type
250 & 750 Baldwin, 144x48 bed, 40" stroke
#408A Bliss Dbl. Action Toggle, 72x54 Bed, w/cushions, mtrs., controls.
#305 Bliss, 8" stroke, late, w/air cushions.
60 ton, Dbl. Crank, 5" stroke, 48x24 bed, late model Waterbury Farrel (3).
200 ton 12" stroke, 27x27 bed, Bliss 43'.
#56 Toledo 4" stroke, 21x21 bed, 15½" shut height.
35 ton, 4, 5, 6" stroke, latest type, pract. new, w/all accessories, Bliss $850.00 ea.
70-85 ton 4" stroke, 21x27 bed, 110 strokes per min., Bliss, latest type.
90-125 ton 4½" or 5" stroke, 60, 80, 110 (optional) strokes per min., late Type.
Inclinable, new, 20 to 70 ton, immed. dely.

AUTOMATICS, LATEST TYPE

#0G B & S, late type
1" New Brit. Grd., 6 spdl.
1⅜" R4—New Brit. Grid.
1½" & 1⅜" Cone—8 spdl. late
9/16", 1", 1¼", 1⅝", 2", RA6 Acme Grid.
2¼" & 2⅜" Cone 6 Spdl.
16" 8 spdl. Bullard Multaumatics, pract. new, (3) with some tooling, dbl. & sgl. index.
12" 8 spdl. Bullards, late type, lots of tooling.

PAUL'S MACHINERY COMPANY

6111 Vermont Avenue
Detroit 8, Michigan
TYLER 7-6300

MONA MEMBER

BENNETT SPECIALS

36" Bullard Mill Spiral Dr., 3 Jaw, 1942
6" bar Ingersoll Floor Type Mill 6' vert. & 6' hor., new 1943
5" bar Sellers Table Type Mill, 48" spin. to table, 100" spin. to outer support, '42.
4" bar Universal Table Type Mill, 60" spin. to table, 96" spin. to outer support, '42
3½" & 4" Landis Floor Type Mills
10"x48" Cinci. Grinder Plain, Late
48" x 19'6" centers Niles Heavy Lathe, Taper, new 1943
42"x84" centers Amer. Lathe, M.D.
36"x32' bed Niles Lathe, 2 carr., T.A.
20"x92" centers Hendey Lathe, T.A., collets
16"/19½"x54" cc Springfield Lathe, 1944
7' Carlton 17" col. Radial, 1943
Nos. 5, 4, 3 & 2 W. & S. Turrets, Late
#4 Gisholt Univ. Turret Lathe, 1942
No. 3K K. & T. Vert. Miller, 1942
48"x48"x24' Gray Planer, 4 Hds., Non-Metallic ways, '42. Var. Voltage
36"x36"x12' Cinci. Hypro Planer, 4 Hds., Var. Voltage, 1943
24"x24"x16' Ingersoll Planer Type Miller, 4 hds., 20 H.P. AC, M.D.
48" N.B.P. Slotter, Grd., Late
15'x¾" Wicks, Bending Rolls, M.D.

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No. 31 Lucas Horizontal Boring Mill, Mtr. Dr.
10'—14' Niles "Extension Type" Vert. Boring Mill, M.D.

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No. 25A—24" Heald Rotary Surf. Grinder.
No. 55H—26" Cochran-Bly Circular Saw.
1" Oster Bolt Threader, Single Head.

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Boring Mills, 24"-36"-42"-52"-72"-96"
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Lathe, Turret 3-A W and S, S.P.D.
Lathe, 36"x28' Betts, T.A., MD.
Millers, Plain No. 3 K and T, No. 4 Cin.
Millers, Vertical No. 3 B and S and No. 4 Cin.
Shaper, 16"-20"-24"-36".
Shaper, 63" Morton Draw Cut.

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No. 2 Brown and Sharpe
1⅝" Greenlee, 6 Spdls (1941)
No. 61 New Britain 6 spindle 2¼"
No. 6 Brown & Sharpes

DRILLS

No. D-8 Colburn No. 6 Morse Taper
No. 1LMS—20"—6 Spdl L.G.
No. 2LMS—26"—2 Spdl. L.G. (1945)
No. 2LMS—26"—4 Spdl. L.G. (1942)
No. 2LMS—14"—4 Spdl. L.G.
No. 2MA6—15"—4 Spdl. Avey
No. 3B—24"—6 Spdl. Edlund (1942)
No. 2—8 Spdl. Leland-Gifford
No. 4 BL Natco 36 Spdls.
7'-15" Col. American Full Universtal

GEAR MACHINES

No. 712 Fellows Auto Indexing (1943)
No. 72 Fellows Gear Shaper
No. 18-H Gould & Eberhardt
11" Gleason Bevel Gear Cutter
72" Cincinnati Gear Cutter
No. 13 Gleason Univ. Tester

HOR. BOR. MILLS

No. 26 Defiance, 4½" bar
No. 31 Lucas, 3" bar
No. 3A Universal, 3" bar
Rockford, 3⅛" bar
No. 48-A Heald Boremastic

GRINDERS

4"x12" Landis, Model H (1942)
4"x18" Landis Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x18" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
Norton Motor Driven Plain Grinders
6"x18" —— to —— 24"x240"

12"x36" Landis Type LCH Universal (1945)

No. 5—8"x24" Covel Hydr. Surf. (1941)
24"x24"x84" Mattison Hydr. Surf
No. 34 Abrasive Surface (1943)
No. 22—12" Heald Rotary Surface
No. 25A—24" Heald Rotary Surface (1943)

72A-3 Heald Internal Grinder
72A-5 Heald Internal Grinder
74 Heald Internal Gdr.
No. 5 Bryant Internal Grinder
No. 16-16 Bryant Internal Gdr.
No. 16-38 Bryant Internal Grinder
No. 24-26 Bryant Internal Grinder

10"x72" Colonial Broach Grinder

LATHES

14"x6' Hendey
15"x5' Sebastian
16"x54" centers LeBlond
18"x6' American
22"x48" centers Monarch
36"x30' Lodge & Shipley
36'—48"x16' Lehman Hydrotrol (1945)
48"x20' Simmons
50"x17' centers LeBlond (1942)

LATHES (Production)

8"x15" Sundstrand, Model D (1943)
16"x22" Sundstrand, Model AA (1943)
12"x18" Lipe Carbo
18"x33" Fay Automatic (1942)
20"x25" Fay Automatics (1942)

MILLING MACHINES

No. 4 Cincinnati Plain (1943)
No. 08 Cincinnati Vert. (1942)
No. 2H Milwaukee Vert. (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati Vert. High Power
No. 1 U.S. Hand Millers
24" Cincinnati Production
No. 1-18 Cinn. Mig. (1940)
No. 2—18" Sundstrand Electromil (1942)
No. M-18 Milwaukee Simplex (1942)
No. M-24 Milwaukee Simplex (1942)
Fitchburg Duplex Miller (1943)
No. 4-48 Cinn. Hyd. Tracer (1942)
No. 45-48 Cinn. Hyd. Plain Tracer (1942)
No. 56-90 Cinn. Hydromatic (1943)
No. 2 Hanson-Whitney Thread
4"x9" Hanson-Whitney Univ. Thrd. Miller
4½"x12" Pratt & Whitney, Model C
6"x20" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
6"x48" Pratt & Whitney Thrd. Miller
6"x132" Pratt & Whitney Thread Miller
10"x48" Hanson-Whitney Thread Miller (1942)
4" Taylor & Fenn Spline, M.D.
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller

MISCELLANEOUS

18" Dill Slotter
Model H-7 Micromatic Hydro Honer
Model H-705 Micromatic Hydro Honer
Model H-2 Micromatic Hydro Honer
Model 200 Micromatic Hydro Honer
No. 22-C Racine Shear Cut Hack Saw
8-M Wells Band Saw
No. 20 Bliss O.B.I. press
No. 2 V & O open back press
No. 0 Bakewell Tapper
Baush Tapper

PLANERS

36" x 36" x 12' Cincinnati
36" x 36" x 18' Gray
48" x 36" x 14' Gray
48" x 48" x 12' Cincinnati

TURRET LATHES

No. 2 B. & S. Screw Machine, Wire Feed
No. 3 Bardons & Oliver (1942)
No. 5 Warner & Swaseys (1942)
No. 5 Bardons & Olivers (1942)
No. 5 Foster, A.C. & Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼ Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

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34" King
72" Cincinnati
72" Niles Extra Heavy
84" Betts

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23 Drilling Machines, various
22 Grinding Machines, various
15 Tapping Machines, various
14 Lathes, various
8 Drill Presses, various
4 Burnishing Machines, Vinco Corp.
3 Screw Machines, 2 Bechler
3 Lapping Machines, Norton Co. and Taft-Pierce
2 Milling Machines
2 Planers; 1 Putnam, 1 Cincinnati

Also Sander, Grinder Belt, Grinder Disc, Burnisher, Band Saws (for metal), Beading Machine, Edging Machine, Stamping Trimmer, Coil Forming Machine, Centering Reel, Squaring Shear, Presses, Riveting Hammers, Riveters, Rivet Squeezers, Dimpling Machine, Testing Machines, Shrinker, Etcher, Planishing Irons, Vacuum Chucks, Gauges, Inspection Tables, Comparators, Parts for various machines.

BIDDING STARTS — 10 A.M.(EDST), SEPTEMBER 24

Mailed bids must be received at Burlington WAA Warehouse #4, before spot bidding begins for the lots in question.

Inspect these machine tools at WAA Warehouse #4, address below, 9:30 A.M. to 2:30 P.M., Mondays through Fridays, except holidays, August 26 to September 24.

Obtain SPECIAL LISTING PHL-OL-464 for further details, including bid forms and terms of sale from Burlington or the Philadelphia WAA Customer Service Center, Lafayette Building, 5th and Chestnut Streets, Philadelphia 6, Pa.

SALE #2 — INDUSTRIAL EQUIPMENT

5286 ft. Rubber Coated Cable, 20 stranded wire
3577 Fuse Extractors for fuse type #3AG
2950 lbs. Welding Weldine Electrodes, Harnishfager Corp., type AW2C, 3 16" dia. x 14" L.
1550 lbs. Welding Rods, SS-5/32"x14"
543 Hydraulic Pumps, Logan, type HTM-17-1F
161 Fan Motors, 12 volts, D.C.
50 Generators, Kato, 6.3 KVA, 110 volts, single phase, 60 cycles
19 Hand Trucks, L-8', 18"x3" wheels, removable handles
7 Copper Battery Chargers, 100 Amps., D.C.
5 Cranes, crawler and tractor types, 2½, 5, 15 and 40 tons capacity
5 Welders, 200 Amps., output 50 volts, D.C.
3 Hydraulic Lift Trucks, Low Sheppard Mfg. Co., cap. 5000 lbs.
2 Electric Forklift Trucks, 3,000 and 4,000 lbs. capacity
2 Box Mailing Machines, Morgan Machine Co., 5 HP. 220/440 volts
1 Snow Plow, Anderson Engine Co., Model #R-42, hydraulically operated
1 Truck Mounted Crane, diesel engine, 30' boom, 5 ton capacity
1 Industrial Tractor, Hebard Co., Model J-233, operated by gas
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The priorities and preferences established by the Surplus Property Act will no longer be in effect, and all buyers participate on an equal basis in these and other WAA sales of personal property held after August 31, 1948.

Property in these sales may be withdrawn up to the time of a sales contract with the buyer, for considerations of National Defense, Disaster Relief and other special programs established by legislation.

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DRILL, Radial, 5' Cincinnati-Bickford
DRILL, Radial, 6' American, Mtr. on Arm
GEAR HOBBER, 36-H Gould & Eberhardt, m.d.
GRINDER, Int. No. 72-A-5 Heald, Hydraulic
GRINDERS, Surf. Nos. 3 & 5 Abrasive
GRINDER, Surf. Rotary No. 25 Heald
HAMMER, Pneumatic, Nos. 4-B & 6-B Nazel
LATHE, 14"x6' L & S, 12-Speed Grd. Hd.
LATHES (3) 18"x10' L & S 12-Speed Grd. Hd.
MILLERS, Pl. No. 3, 4 & 5 Cincinnati
MILLER, Thread, No. 40 Lees-Bradner
MILLER, Duplex, 24" Cincinnati
MILLER, Univ., No. 4 Cincinnati
PLANER, 30"x30"x8' Liberty, M.D.
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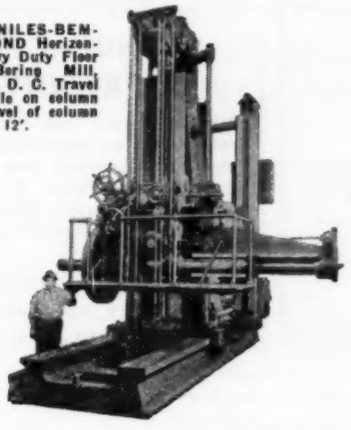

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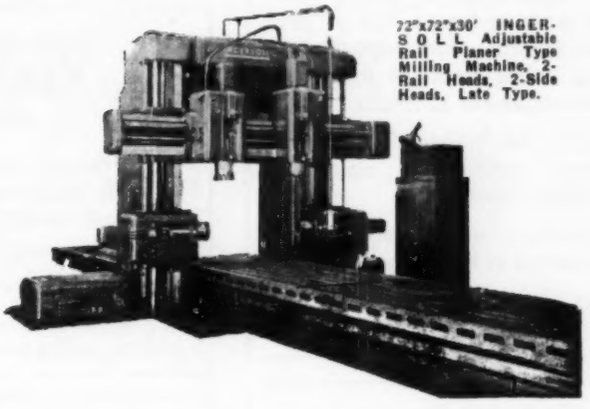

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10' x 3/16" OHL Squaring Shear
#4A W. & S. Turret Lathe
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4N NAZEL Hammer
#2 CINN. Centerless Grinder, Filmatic
#42 HEALD Boromatic, 2 Spindle. Single End
60" & 84" Roller Levellers

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No. 3 WARNER & SWASEY Turret Lathe, 1942
No. 4 CINCINNATI Plain Mill, 1941
No. 1224 KEARNEY & TRECKER Simplex, 1943
36" OHIO Shaper, 1943
6"x18" CINCINNATI Grinder, 1943
615A FELLOWS Gear Shaper, 1943
12" GLEASON Bevel Gear Generator, 1941
No. 12 BARBER COLEMAN Gear Hobber 1943

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TURRET LATHES: 5—Warner & Swasey Universal No. 3A, No. 3, No. 4 and No. 5, Warner & Swasey No. 2.

RADIAL DRILL PRESSES: Cincinnati Gilbert 4'-11" Column; 4' Morris "Nor-Speed" and 4' Western.

GRINDERS: Cincinnati Centerless; Brown & Sharpe No. 13 Universal; Brown & Sharpe Surface; Landis Hydraulic; Majestic Internal; Excello Tool; 95—Pedestal and Flexible Shaft Grinders.

AUTOMATIC SCREW MACHINES: 2 Brown & Sharpe No. 0G and 2G, fully automatic; Cleveland 3¾" automatic.

HYDRAULIC PRESSES, PUNCH PRESSES: Williams & White 1200 Ton Hydraulic Press 3 column motorized; Lake Erie 500 Ton Hydraulic Press completely equipped; 12—Bliss Niagara & Toledo punch presses, Nos. 28, 7, 7B, 6, A4, 3½ and 44.

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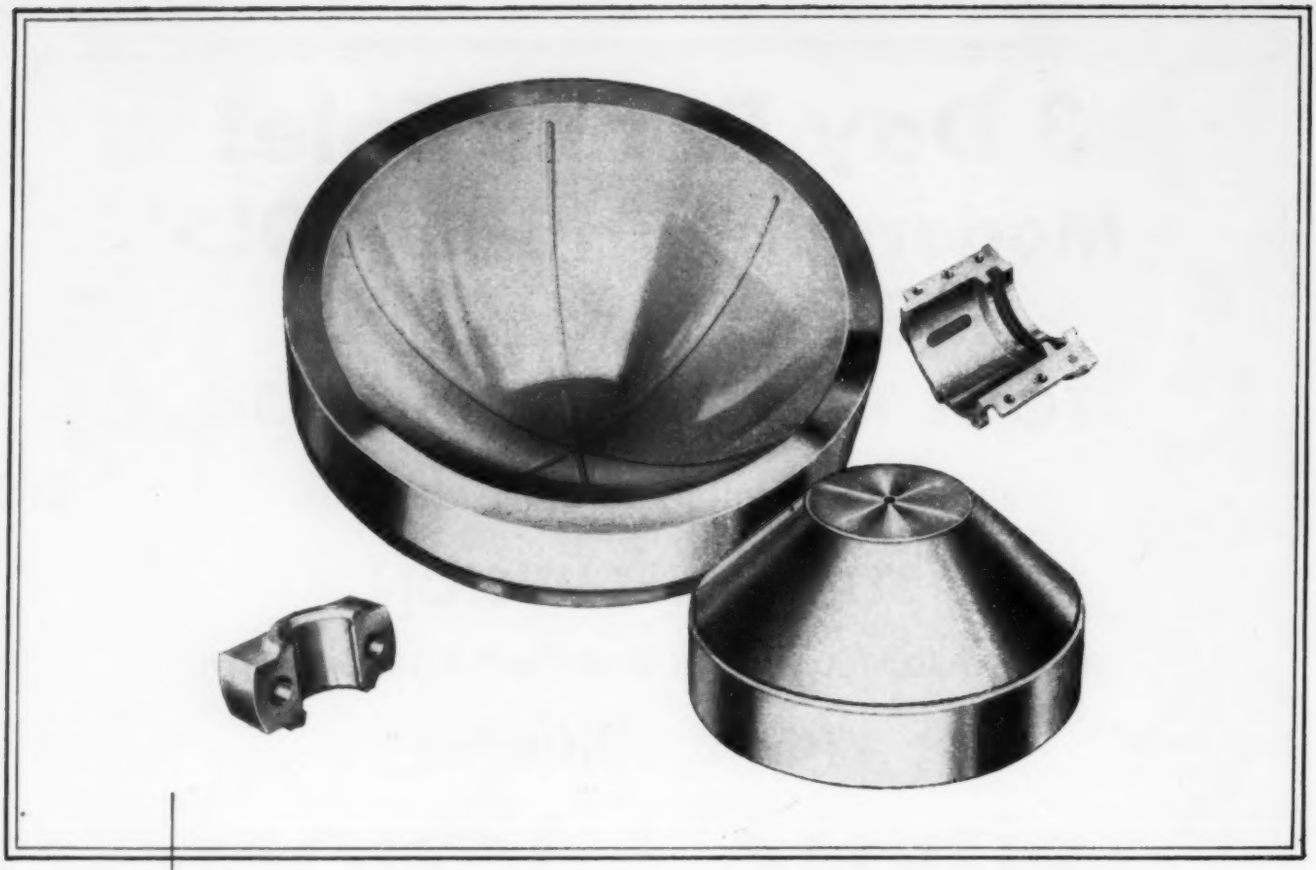

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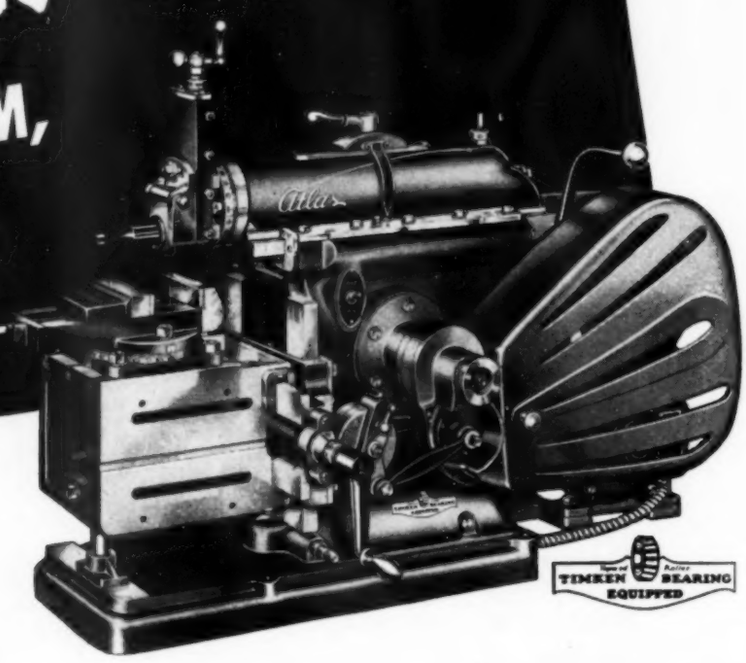

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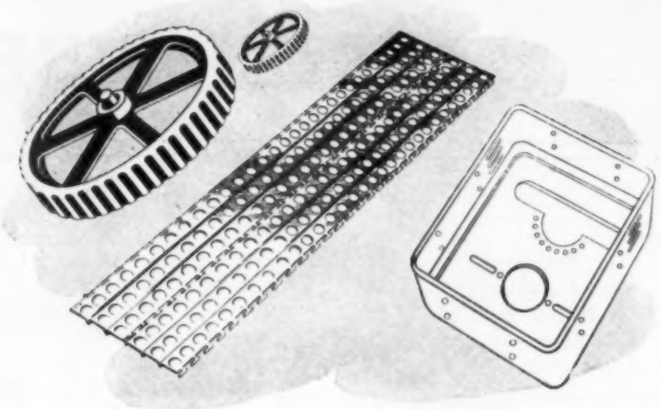

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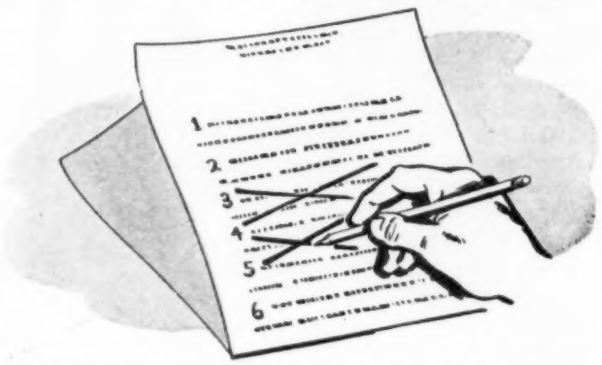

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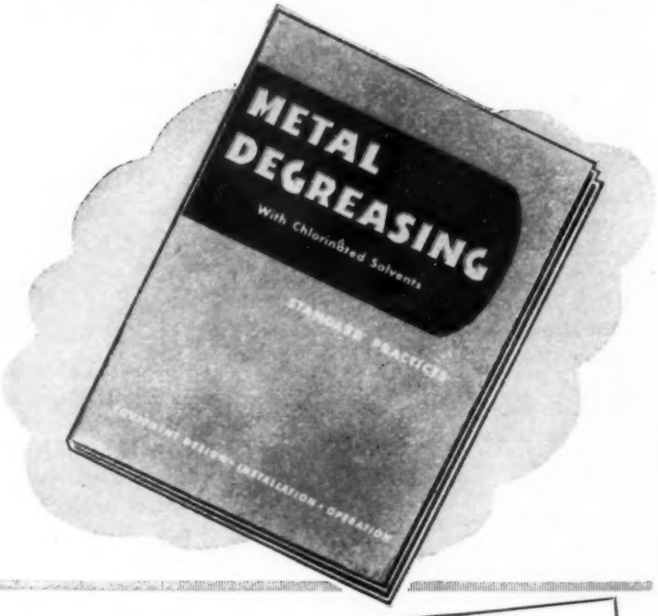

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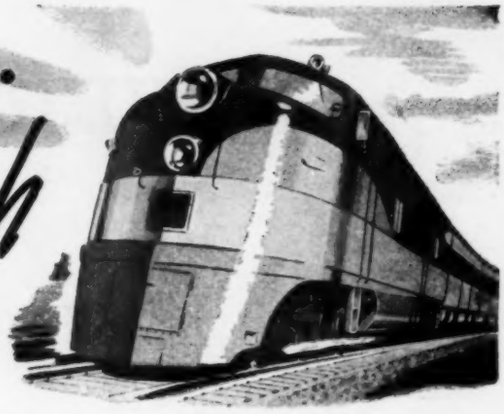

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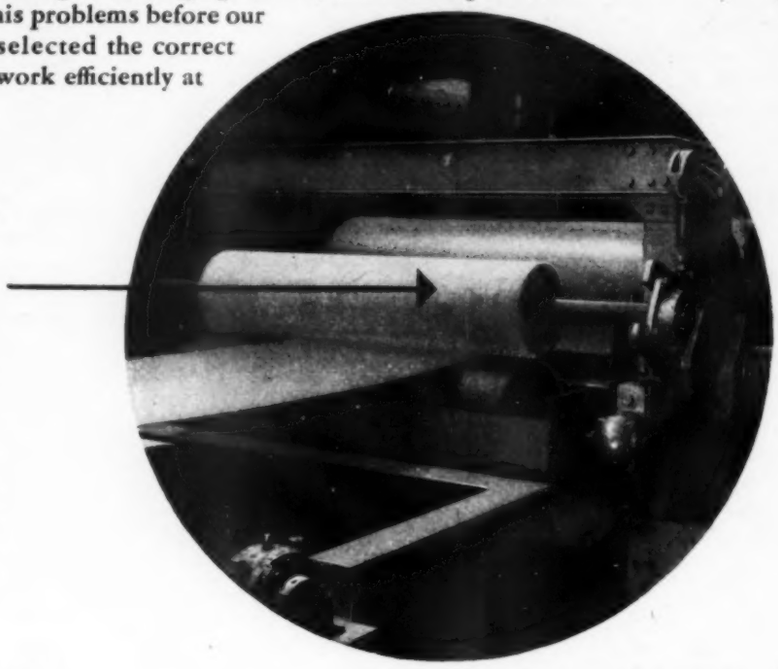

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STEEL	RUBBER	SHOE MANUFACTURING
PLASTICS	PAPER	& REPAIRING

In the complete Pittsburgh line are brushes of all types, including "Perfect Balance" sections, wheels and assemblies. Uni-fill scratch brushes as well as paint and other maintenance brushes. Consult the Pittsburgh engineering representative. He will gladly work with you in developing any type of power-driven brushes to meet your particular finishing specifications.

Use only Power-Driven Brushes By Pittsburgh—it pays

You can depend on Brushes by Pittsburgh to meet your particular finishing requirements. Perfect balance, top performance, enduring economy and a minimum of lost time in changeovers–Pittsburgh Power-Driven Brushes are specifically engineered to do your job right.

FREE!

Steel rule and depth gauge, 6", complete with pocket clip, and atttractive leather case. Yours for the asking . . . write Pittsburgh Plate Glass Company, Dept. W-3, Baltimore 29, Md.

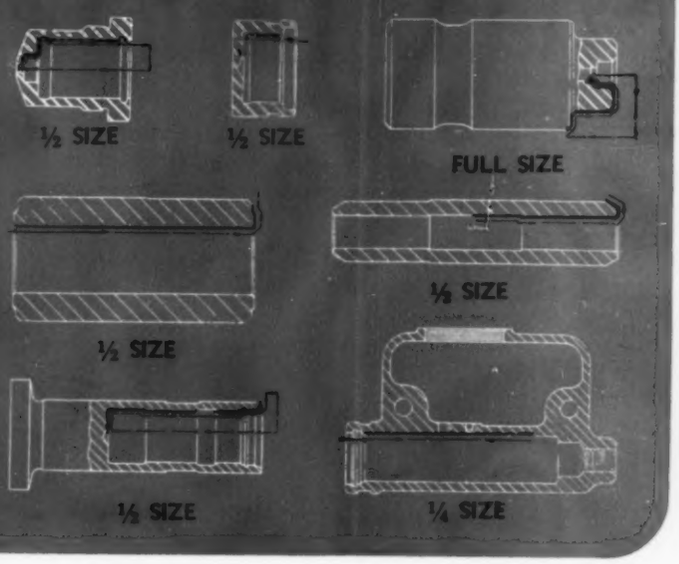
Power Driven **BRUSHES**

BRUSHES · PAINT · GLASS · CHEMICALS · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

New boring and turning machines TO BROADEN YOUR PROFIT MARGIN

Model 36



On one of the parts illustrated the bore specifies a .0005 back taper. Many bores have a .001 total limit. On one job the production rate is 1,080 pieces per hour; on another, production was increased from 180 to more than 300. Specifications for the valve guide call for a .0001 limit on size from one end to the other, .0002 for concentricity, and a .0006 limit from piece to piece.

Money-saving speed, accuracy and ease of operation make this new line of precision contour turning and boring machines earn their way. Cam and air actuated, the tools positively repeat from piece to piece unaffected by temperature variations.

High production is assured by high spindle speeds and lifetime sealed lubrication of spindle bearings, and by the fact that 2 or more pieces are finished simultaneously with rapid traverse on all idle motions.

An unlimited variety of set-ups can easily be arranged. In addition to straight boring and turning, facing and chamfering, it will accurately follow contours cut on its cams, and will produce lands, recesses, flanges, steps, counterbores, and radii . . . all with a single point tool. Only one dimension cut by this tool requires inspection.

The Machine Tool Show unquestionably demonstrated the enormous new possibilities of automatic machinery. Are you falling behind your competitors by not at least investigating? We will gladly show you how we are changing expensive boring and turning operations into profitable productivity. *Productivity, not price, is the measure of a machine.*

NEW BRITAIN AUTOMATICS COST LESS PER FINISHED PIECE.

THE NEW BRITAIN MACHINE CO.

NB

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Automatics

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Why Timken alloy steels make better forgings at less cost

TIMKEN alloy steels have superior surface and internal quality. This, plus uniform forgeability, means better forgings at less cost.

From bar to bar and from heat to heat, the high quality of Timken forging bars is always uniform. Forgeability, composition and response to heat treatment do not vary. That's why Timken forging bars reduce delays and rejects, improve the quality of the finished forgings.

Uniformity of Timken forging bars is assured by The Timken Roller Bearing Company's rigid and complete quality control. By its advanced melting and finishing techniques. By its years of research and experience as the world's largest producer of specialty alloy steels.

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YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH